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DEVOTED TO THE IMPROVEMENT OF CITIES

CONCRETE CONSTRUCTION, PAVING, SEWERAGE, WATERWORKS, STREET LIGHTING, PARKS, GARBAGE DISPOSAL, BRIDGES.

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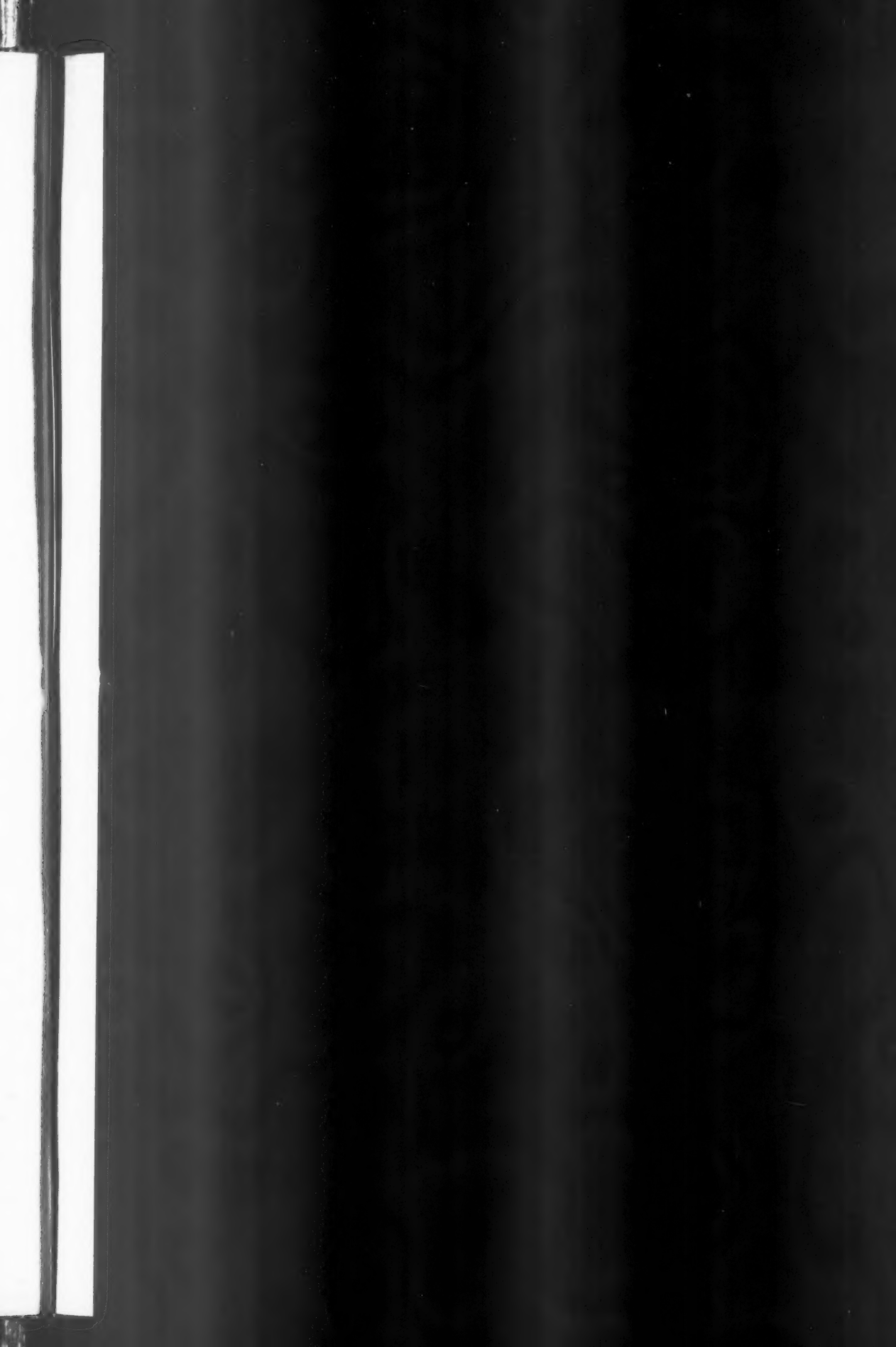

MUNICIPAL ENGINEERING

VOLUME XXXIII. NOVEMBER, NINETEEN HUNDRED SEVEN. NUMBER FIVE.

THE DETROIT CONVENTION OF THE AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.

Report of Proceedings.

The first session of the fourteenth convention of the American Society of Municipal Improvements was set for three o'clock on the afternoon of Tuesday, October 1, at the Detroit Art Museum. But few delegates had made their appearance at that time and an adjournment was taken until Wednesday morning that those present might have an opportunity to see the sinking of the first section of the new railroad tunnel to connect Detroit with Windsor, Ontario. This tunnel is laid in a novel manner and the meeting was at a fortunate date for the members present. A trench is excavated deep and wide enough to receive the twin cylinders forming the tubes for the two railway tracks, and these cylinders of riveted steel plates properly braced are then sunk into place in the trench and surrounded with concrete. The tunnel cylinders are handled in lengths of about 275 feet and the first section was sunk into place on October 1. A few more delegates arrived during the afternoon and all were guests of Mr. R. K. Davis, the chairman of the local committee at the theater in the evening.

The Wednesday morning and evening sessions were held in the auditorium of the Art Museum and the few members present were almost lost in its space.

After a very happy address of welcome by David E. Heineman, the president of the Detroit Common Council and the League of Michigan Municipalities, and the response by Vice President James Owen, the regular reports of officers were read, the President's address was heard and papers were presented on "Street Cleaning Methods in Detroit" by Frank Aldrich, superintendent of streets, on the new "Septic Tanks and the Bacterial Beds in Toronto" by C. H. Rust, city engineer and on some "Experiments on Crushing Strength of Sewer Conduits" by J. N. Hazlehurst, engineer of Board of Public Works, Mobile, Ala. The report of the committee on sewerage and sanitation was made by C. H. Rust, chairman, and that of the committee on street cleaning by C. D. Pollock, chairman. These papers are printed in full or in part in following pages. So late a start was made that there was little opportunity for discussion. Some difference of opinion was experienced concerning the effect of flushing streets with water from hose or cart under pressure, some considering it dangerous to the durability of the pavements and others agreeing with the paper in considering it at least innocuous if not beneficial, but all agreed that the streets were most thoroughly cleaned in this manner. One member called attention to the effect of changing the direction and force of the flushing stream as important in estimating the destructive effect of the water. Little complaint was made of the increase in cost of cleaning catch basins or of cleaning sewers where catch basins are not used.

At Wednesday night's session Prof. A. H. Griffith, Director of the Museum of Art gave an interesting address descriptive of the city of Detroit, of the past, present and future, particularly regarding the beautifying of the city and the plans, completed and in prospect for parks, boulevards and civic centers.

Papers were presented by Frank P. Smith of Chicago on "Final Disposal of

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GEO. W. TILLSON,
President A. S. M. I.

Garbage and Refuse," by William A. Howell, engineer of streets and highways, Newark, N. J., on "A Recent Investigation of Various Bituminous Materials Used in Expansion Joints of Brick Pavements" and by J. W. Howard, consulting engineer, New York, on "Density of a Pavement an Important Element of Its Durability" and on "Requirements and Tests for Best Qualities of Paving Bricks." Again there was but little discussion although there were some objections made to statements in Mr. Smith's paper, such, for example, as that he knew of no municipal garbage reduction plant, while Cleveland is a prominent example of municipal ownership and operation of a garbage reduction plant. The most important of these papers will appear in this and subsequent numbers of MUNICIPAL ENGINEERING.

The action of the Executive Board in setting aside $500 for the use of the secretary in advertising the association and its next meeting was approved by the society. The habit has been formed of depending upon the president for work of this sort and it has been justified by results at two or three recent conventions, but when this work is neglected the result is a small attendance and it was thought best to transfer the work to the secretary, who, by custom, is a fairly permanent office holder.

Thursday's sessions were held in the parlor of the Cadillac Hotel, which was better suited to the size of the convention, even when augmented on that day by nearly all of the new members from the Southern States who joined at Birmingham and by still others. These enthusiastic members, who recognize the value of the society, almost succeeded in bringing the attendance on the last regular day up to the average.

At the morning session a report was presented from the committee on Electric Street Lighting, by E. A. Fisher, chairman, city engineer of Rochester, N. Y. Papers were presented by E. A. Fisher on "Ornamental Street Lighting"; by W. H. Floyd, civil engineer, St. Joseph, Mo., on the St. Joseph electric lighting plant; by L. H. Weisleder, Cincinnati, O., on "Franchises for Lighting Companies"; and by Wm. M. Daly, general superintendent electric light commission, on "The Detroit Electric Light Plant" and by John B. Hittell, chief engineer of streets, Chicago, Ill., on "The Guarantee Clause in Paving Specifications of the City of Chicago."

There was little opportunity for discussion. The principal points made in the discussion of the electric light papers were regarding the insufficiency of candle power as a means of measuring service rendered and the lack of a

A. P. FOLWELL,
Secretary, A. S. M. I.

suitable measure. Mr. L. H. Weisleder has formulated his opinion there expressed and it will be found in this number of MUNICIPAL ENGINEERING in the new department "From Workers in the Field." Mr. Charles Carroll Brown presented some figures comparing the cost of operation and efficiency of various kinds of street lamps, which will be found in the same department in a communication from the city engineer of Paris, Ill., from whom they were quoted.

At the evening session the work of the committee on street paving was taken up, the report being presented by A. W. Dow, chairman, chemical engineer, New York, and papers were presented on "Pavement Guaranties from the Contractor's Standpoint" by W. H. Andrews of Hamilton, O.; on "Specifications for Treating Wooden Block for Paving" by Geo. W. Tillson, chief engineer, bureau of highways, borough of Manhattan, New York; on "Back Filling Trenches" by Geo. C. Warren, Boston, Mass.

The report of the committee on City Government and Legislation was presented by Horace Andrews, chairman, consulting engineer, Albany, N. Y., and an excellent paper descriptive of the "Municipal Conduit System of Auburn, N. Y.," by J. Walter Ackerman, City Engineer.

L. V. CHRISTY,
Treasurer A. S. M. I.

JULIAN KENDRICK,
Vice-President A. S. M. I.

Atlantic City was chosen as the next place of meeting and practically the same list of officers was elected, the only changes being the promotion of Geo. W. Tillson to to the presidency and the transfer of A. P. Folwell to the secretaryship. The other officers are James Owen, Montclair, N. J., first vice president; Julian Kendrick, Birmingham, Ala., second vice president; Fred Giddings, Atchinson, Kas., third vice president; L. V. Christy, Wilmington, Del., treasurer; A. F. Eggers, Newark, N. J., T. C. Hatton, Wilmington, Del., R. H. McCormick, Detroit, Mich., financial committee. A committee to attend the coming convention of the National Municipal League was authorized.

This was the last session listed on the program, but there were so many papers left that a session was held Friday morning with perhaps fifteen members present. At this meeting the work of the paving committee was continued and papers were presented by E. A. Harper, city engineer, Kansas City, Mo., on "Methods of Improving Quality of Asphalt Pavements"; by F. P. Smith, chemical engineer, New York, on "What Steps Shall a City

take to Insure Good Asphalt Pavements."

In the discussion of these papers the general opinion expressed was in favor of the employment of expert engineers for making specifications and inspecting construction and the abandonment of the ordinary periods of guaranty.

The report of the committee on Park Development and Maintenance, was presented by James Owen, chairman, consulting engineer, Montclair, N. J.,

FRED GIDDINGS,
Vice-President A. S. M. I.

and that of the committee on Fire Protection by Alcide Chaussee, chairman, superintendent of buildings, Montreal, Can. Mr. Chaussee also presented a paper on "Fire Proofing."

The entertainment features were in the hands of a local committee of which R. K. Davis, general manager of the Detroit Reduction Co., was chairman. Mr. Davis was indefatigable and was ably seconded by the president of the city council, the city marshal and many others. Aside from the special entertainments already mentioned, the society, as guests of the business and professional men of Detroit saw the city in automobiles on Wednesday afternoon. The trip included the boulevard, the water works park and Belleisle park and showed the beauties of the city close at hand. On Thursday afternoon the city's chief beauty was seen on a steamer, the society being the guests of the city of Detroit. The trip extended down the river the entire length of the city's river front and up the river to Walkerville, Ont., crossing then to the Detroit side to witness an exhibition of the fireboat of the Detroit fire department, which demonstrated its power and showed its probable efficiency in a fire on or near the river front. On Friday there were trips to inspect brick pavements, the asphalt paving plant, the municipal electric lighting plant, the garbage loading station and other points of interest, and one or two who remained until Saturday visited the plant of the Detroit Reduction Company, some fifteen or twenty miles out of the city.

Many of the papers presented follow in abstract or in full and others will appear in subsequent numbers of MUNICIPAL ENGINEERING.

The register showed the following names:

J. Walter Ackerman, city engineer, Auburn, N. Y.

L. W. Anderson, city engineer, Grand Rapids, Mich.

W. G. Austin, American Asphalt and Rubber Co., Kalamazoo, Mich.

R. W. Ball, Henderson, Ky.

E. G. Barrow, city engineer and manager of water works, Hamilton, Ont.

C. V. Baumann, commissioner of public works, Newark, N. J.

Will P. Blair, secretary National Paving Brick Manufacturers' Association, Terre Haute, Ind.

Frank J. Bock, commissioner of public works, Newark, N. J.

Ben E. Briggs, city engineer, Erie, Pa.

Charles Carroll Brown, consulting engineer, MUNICIPAL ENGINEERING Magazine, Indianapolis, Ind.

W. C. Campbell, city engineer, Columbus, Ga.

Alcide Chaussee, superintendent of buildings, Montreal, Que.

L. V. Christy, secretary street and sewer department, Wilmington, Del.

S. E. Cole, Pittsburg, Pa.

H. L. Collier, commissioner of public works, Atlanta, Ga.

E. L. Dalton, city engineer, Dallas, Tex.

Wm. F. Day, assistant engineer of sewers, Detroit, Mich.

Arthur R. Denman, president of board of public works, Newark, N. J.

A. W. Dow, chemical engineer, Dow and Smith, New York.

Augustus F. Eggers, commissioner board of works, Newark, N. J.

Frank T. Elwood, commissioner of public works, Rochester, N. Y.

John H. Ely, architect, Newark, N. J.

E. A. Fisher, city engineer, Rochester, N. Y.

A. Prescott Folwell, Municipal Journal, New York.

A. Julius Freiberg, delegate of National Municipal League, Cincinnati, Ohio.

Fred Giddings, city engineer, Atchison, Kan.

Thos. T. Halpine, commissioner board of public works, Newark, N. J.

Jacob Haussling, mayor, Newark, N. J.

David E. Heineman, persident of city council, Detroit, Mich.

A. J. Hill, American Asphaltum and Rubber Co., Chicago, Ill.

William Howe, Pioneer filler, Chicago, Ill.

Wm. A. Howell, engineer of street department, Newark, N. J.

G. M. Ingram, president of Southern Bitulithic Co., Nashville, Tenn.

Julian Kendrick, city engineer, Birmingham, Ala.

Geo. H. Lambert, commissioner board of works, Newark, N. J.

E. F. Lowery, president Reinforced Concrete Pipe Co., Jackson, Mich.

H. D. Malone, Pioneer filler, Chicago, Ill.

Ed. F. Marschner, president board of assessors, Detroit, Mich.

R. H. McCormick, city engineer, Detroit, Mich.

J. K. Mitchell, general assistant engineer, Detroit, Mich.

James Owen, consulting engineer, Montclair, N. J.

W. J. Parkes, city engineer, Pine Bluff, Ark.

Otto C. Plessner, Arthur Koppel Co., Chicago, Ill.

Ed. S. Rankin, engineer sewer department, Newark, N. J.

P. C. Reilly, president Republic Creosoting Co., Indianapolis, Ind.

M. C. Robbins, Chicago, Ill.

Wm. D. Russell, Detroit, Mich.

J. C. Rock, general agent A. L. Barber Asphalt Co., Washington, D. C.

C. H. Rust, city engineer, Toronto, Ont.

M. R. Sherrerd, chief engineer, Newark, N. J.

G. E. Sly, New York.

Wright Smith, chief engineer board of public works, Mobile, Ala.

Johnston Stuart, foundry, Detroit, Mich.

Geo. W. Tillson, engineer of highways, Manhattan borough, New York.

G. W. Tonson, director of public service, Toledo, O.

E. E. R. Tratman, Engineering News, Chicago, Ill.

L. H. Weisleder, engineer Bell Telephone Co., Cincinnati, O.

W. M. Wilson, city engineer, Gadsden, Ala.

W. H. Woods, Western Electric Co., Chicago, Ill.

The exhibitors were well located in the gallery leading to the auditorium of the Art Museum. Those making displays were:

The American Asphaltum and Rubber Co., Chicago, Ill.

The A. L. Barber Asphalt Co., Washington, D. C.

The Reinforced Concrete Pipe Co., Jackson, Mich.

Warren Brothers Company, Boston, Mass.

New members elected who were not present at the meting were:

D. B. Goodsell, assistant engineer bureau of highways, Manhattan borough, New York.

W. B. Fuller, engineer in charge of filters, department of water supply, Manhattan borough, New York.

Jas. J. Smith, city engineer, Grand Forks, N. D.

Frank L. Marston, consulting engineer, Stockton Springs, Mo.

J. E. Putnam, assistant city engineer, Rochester, N. Y.

POLITICS IN MUNICIPAL GOVERNMENT.

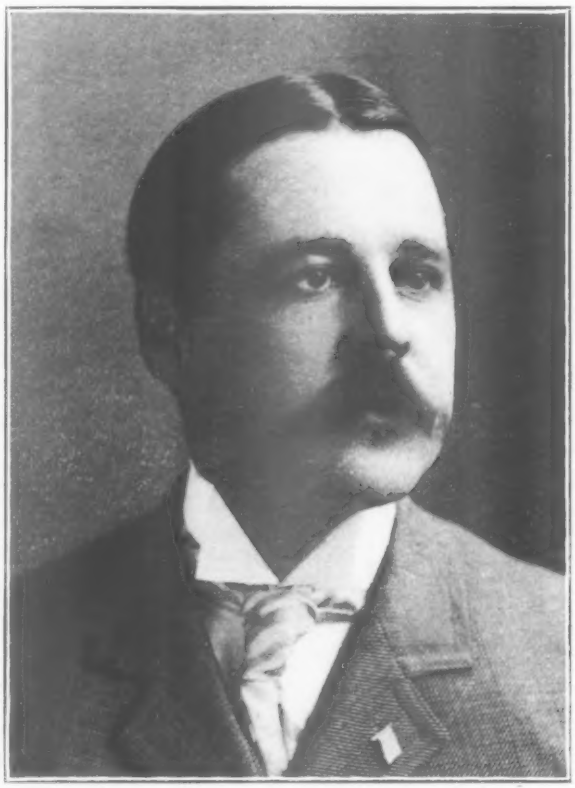
ABSTRACT FROM PRESIDENT'S ADDRESS,

By Morris R. Sherrerd, Chief Engineer, Newark, N. J.

To obtain the best results in handling the important problems which confront the smallest as well as the largest of our municipalities politics should be eliminated from their consideration. It is not meant in using this expression to convey the idea that tenure of office is the controlling thought. A broader view would suggest that as a most effective and sta-

ble method of arriving at the best results the municipal officer himself and particularly the heads of the engineering departments of our city governments should strive continually and disinterestedly to eliminate politics from his own office, beginning with his own consideration of municipal affairs as shown in his official reports and advice. An esprit du corps can be established in the engineering department of a municipal government, if properly fostered, which should result in as efficient management of this branch of municipal affairs as is obtained in a large private corporation.

It must be admitted that it is difficult and some may say it is impossible that any department of municipal government can be satisfactorily maintained on this basis, but where it has been conscientiously inaugurated and adhered to, perhaps with many set-backs, it has certainly resulted in the improvement of the service rendered and in great advantage to the municipality. Such a management of the engineer's department will result in leaving the engineer free to give proper and effectual consideration to the technical problems which confront him. The inauguration of civil service, provided due weight is given to a man's practical experience, would in a measure eliminate the political question in the admission of new employes in the department. To more readily provide that the action of the engineer in charge of a municipal department may be independent of political bias it would seem advantageous that such engineer act in an advisory capacity for the different public boards with which his duties are concerned rather than that he should be a member of such boards.



M. R. SHERRERD,
Chief Engineer, Newark, N. J.

THE PUBLIC LIGHTING PLANT OF DETROIT.

By William M. Daly, General Superintendent.

The events which led to the establishment of the public lighting plant of this city were the usual ones. Private corporations furnishing a public service, generally tending rather to corrupt the public officials dealing with them than to bettering the service, caused the growth of the sentiment and ultimately the demand for a municipally owned and operated plant, and Mayor Pingree was the man to bring it about. In his message of Jan. 12th, 1892, he submitted reports from 88 cities in the United States, showing that Detroit had paid a price greatly in excess of the average. Again in his message of Jan. 10th, 1893, he submitted reports from 92 cities owning and operating their plants showing the cost to be considerable less than the lowest contract price in any city lighting by contract. In view of this and the ever increasing complaints of lamps out he had a bill prepared, introduced and finally adopted in the legislature of the state. This act, signed by the governor, March 18th, 1893, conferred the power upon the city of Detroit to issue bonds to the extent of $800,000 for the purpose of buying or building a municipal lighting plant. It also created a commission, to be appointed by the mayor and approved by the council, for that purpose and to operate the same.

The referendum vote on the question, submitted April 3rd, 1893, resulted in its adoption by the people, 15,822 yeas to 1,245 nays. April 23rd, 1893, the Common Council adopted a resolution to establish such a plant and on May 9th, authorized the issue of bonds to the amount of $600,000, approved by the Board of Estimates May 19th. May 24th, 1893, the commission having been appointed and confirmed, the Common Council directed them to take the necessary steps for the establishment of the plant and on December 22nd the bonds were sold at a premium of $27,540.

The three year contract with the Detroit Electric Light & Power Co. expiring June 30th, 1893, the council having rejected their proposition on March 14th, the Public Lighting Commission aranged with the company to have them continue lighting the city from month to month at the following rates:

827 lamps at former contract price.
440 lamps at 35 cents per night.
12 lamps at 48 cents per night.

The Detroit Electric Light & Power Company's proposition rejected by the council above referred to, was as follows:

One year contract, per lamp per year	$155.73
Two year contract, per lamp per year	148.43
Three year contract, per lamp per year	124.10
Five year contract, per lamp per year	120.45
Seven year contract, per lamp, per year	109 50
Ten year contract, per lamp per year	102 20

When the Public Lighting Commission began lighting the city, in April, 1895, a uniform rate of $11.15 per lamp per month was agreed upon as a basis for all lights still to be furnished by contract until the municipal plant was in full operation, Oct. 1st, 1895.

As the scope of this paper is too limited to go into the details of construction work, I would refer those interested to the annual reports of the Commission, but, as bearing on the mooted question of depreciation, I would here state that the site selected for the plant has a frontage of 218 feet on Atwater St. and 161 feet on the channel lines of the river, that the average depth of the lot is 365 feet, and its area 64,175 square feet, and that it cost $63,125.

The buildings erected thereon cost	$ 72,247.78
The several lines of conduits and tunnels comprising 181,794 duct feet cost inclusive of manholes..... This is at the rate of 23¾ cents per lineal ft. for three-inch vitrified clay ducts laid in concrete.	43,382.58
33,258 feet of 2½-inch iron pipe at 34¾ cents per foot.	11,570.81
	$190,326.17

Here, then, we have nearly one-third of the original investment that has not only not depreciated but has considerable more worth to-day, and for the purpose of making a proper comparison, I tabulate the services and their cost for the first decade.

The records of the city controller's office show that the entire amount appropriated by the council and the Board of Estimates and paid out by

the city on account of the lighting plant was as follows:

Original investment.....		$ 655,508.90
	Operation.	Investment.
1895 .	125,603.27	32,675.27
1896 .	124,255.00	25,745.00
1897 .	121,000.00	83,780.00
1898 .	56,000.00	23,000.00
1899 .	95,000.00	41,945.00
1900 .	96,000.00	.....
1901 .	98,000.00	55,328.00
1902 .	103,975.00	82,200.00
1903 .	117,917.00	55,763.50
1904 .	122,246.15	56,510.00
	$1,059,996.40	$456,946.50
Total investment		$1,112,455.40
Total for operation and maintenance		1,059,996.40
Grand total paid by the city for lighting and plant		$2,172,451.80

Services rendered:

Year.	K. W. Current for Arc.	No. of Arc Lamps.
1896	2,407,232	1,481
1897	2,716,628	1,600
1898	2,973,135	1,820
1899	3,182,293	1,919
1900	3,327,453	2,002
1901	3,475,389	2,042
1902	3,672,255	2,302
1903	4,284,576	2,454
1904	4,399,291	2,597
1905	4,780,397	3,005
Total	35,218,649	21,222

Year	K. W. Current for Incand.	Buildings Supplied	No. of Incand. Lamps	Motors
1896	220,653	14	2,503	..
1897	263,784	19	3,006	..
1898	299,630	30	3,901	..
1899	357,274	34	4,911	..
1900	461,597	40	6,679	..
1901	497,961	42	6,948	..
1902	651,594	62	11,780	..
1903	984,820	108	14,183	32
1904 1,008,814		122	14,871	35
1905 1,104,144		132	14,696	39
	5,842,271			

Stating the illuminating power of the incandescent lamps and motors in arc lights, the total number of arc lights for the decade was 24,788 (an average of 2,479 arc lights per year) thus, as President Hetherington in the tenth annual report of the Commission says, if all the property of the Public Lighting Commission including land, buildings, etc., were obliterated, wiped out of existence, the total cost to the city of Detroit would have been $87.63 per arc lamp per year. The lowest contract bid for the same time was $102.20.

But, the opponents of municipal ownership claim, this showing is not fair to them; that within this time so many improvements in machinery, etc., have been made, reducing the cost of the service, and that private corporations would have rendered the same or better service for less money. Happily we are in a position to meet this assertion. Comparisons may be odious but the one that Mr. Hetherington makes, in the tenth annual report above referred to, illustrates this point so conclusively in every respect that I deem it proper to draw your attention thereto.

The city of Buffalo is a well lit city, though no more so than Detroit. It is in the same class as Detroit in every respect, etc., except that its location is more favorable to secure cheaper electric current from Niagara Falls. This advantage ought to enable Buffalo to excel all other cities as far as lowness of costs of lighting is concerned.

At the time Detroit's plant went into operation, Buffalo entered into a ten year contract starting with a rate of $117.75 per arc light of 2,000 c.p. per year. This was reduced in 1897 to $100.00 and again in 1902 to $75.00, making the average cost per arc light for the ten years $91.77, or $4.14 more per arc lamp per year than the city of Detroit has paid in the same time. Now, while this in itself ought to be considered a favorable showing for Detroit's municipal plant, I wish to emphasize this fact: that while Buffalo has at the end of the decade nothing to show for its expenditure except a lot of receipted bills, Detroit has not only those but a fairly up to date plant worth at least a million dollars.

The number of lamps operated, the output of the plant in k. w. hours of current and the total amount paid by the city for the installation, operation and maintenance of its plant stand out so prominently that all juggling with percentage of depreciation, etc., can not possibly befog them.

Lately the plant, its system of accounts, its records and the Commission's report based thereon have been subjected to exhaustive investigations by experts of international renown. Although I have not received a copy of the official report of the investigating committee of the Civic Federation, I understand, from what the newspapers report, the Committee does not seem to have found anything wrong of sufficient importance to mention it.

And now I deem it necessary to touch the tender spot, the point which more than any other is criticised and atacked by private corporations and their editorial staff, the point which their experts glory in to befog with technical terms—the actual cost price per arc light, of a given candle power, and per k. w. hour to the consumer, who in this case is the city.

In establishing this cost price the Commission has to deal with existing conditions of the plant, the cost of coal, etc., and the cost of labor. The system adopted by the Commission to ascertain the actual cost of an arc lamp of 2,000 c. p. per year and that of the unit or k. w. hour current for incandescent lighting is as follows: All the expenditures of the year which are necessary for maintenance of the established plant are charged to the product, as well as all operative expenditures. The maintenance is subdivided into arc and incandescent. If an old machine or contrivance is replaced by a new one the difference between the price of the new and that of the old one less the depreciation of 3 per cent. per year and actual amount received in its sale is charged to maintenance and thus actually to the product, be it incandescent current or arc light. Thus, President Stanton, in the 12th annual report states the amount expended in operation and maintenance of the arc light system to be:

Arc, $112,201,87 for 5,601,648 arc k. w. hours.
Incandescent, $31,659.20 for 1,580,577 incandescent k. w. hours.
Total, $143,861.07 for 7,182,225 k. w. hours.

The average number of 2,000 c. p. arc lamps operated during the year was 3,374. $112,201.87 divided by 3,374 makes the cash cost per arc light $33.15. To this cash cost per arc lamp are added the fixed charges as follows:

Arc lamps, machinery and towers discarded	$ 6,281.05
3 per cent. depreciation on entire plant at $1,054,-527.45	31,635.83
4 per cent. interest on net investment July 1st, 1906, at $902,641.25	36,105.65
Lost taxes at an estimated assessed value of $594,-900 at the rate of $18.23 per $1,000	10,845.03
Total	$ 84,867.55
Cash cost of maintenance and operation	143,861.07
Total	$228,728.62

This divided proportionaely between the arc and incandescent is:

Arc	$178,392.80
Incandescent	50,335.82
Thus the operating disbursements per arc lamp are	$33.25
Depreciation on account of discarded machinery, etc.	1.45
Depreciation on investment at 3 per cent.	7.31
Interest on investment at 4 per cent.	8.35
Lost taxes	2.51
Gross cost per arc lamp	$52.87
Cash cost per k. w. hour of incandescent lighting	.02003
Its proportionate share of depreciation, interest, etc.	.01182
Gross cost per k. w. hour	.03185

There is no secrecy connected with the ascertaining of the cost. No arrogant display of a "higher scientific knowledge" is necessary to determine them. The Commission is dealing only with plain and simple facts, open to the examination of any one. It is not involved in the dark intricacies of a sliding scale system with special discriminations. It has only one rate, that of the true costs and were it empowered to do commercial lighting this democratic system would apply to all alike.

I have so far confined my remarks mainly to the economic value or price of current as produced and distributed by our plant. But conducted as it is and for the purpose of rendering at cost service that otherwise in the hands of private corporations would be made to pay handsome dividends, not mentioning water, its very existence is a menace to all depredatory public lighting contractors and all those supplying commercial light and power under any other than a flat scale. It is therefore easily seen that Detroit's municipal plant has been on the firing line since its purposes were recognized, for it leads to comparisons and it is these comparisons that are feared by those that seek an unfair profit. In this way Detroit's plant has been of service to all other cities.

THE CARE AND MAINTENANCE OF PARKS.

Report of Committee on Parks of A. S. M. I.

By James Owen, Chairman, Montclair, N. J.

The three main functions of park development and maintenance are first, hygiene; second, education, and third, aesthetic. While the order as given may be properly criticised, yet in our daily life the body is or should be our first consideration, as the mind is trained according to its physical capacity, so it is proposed in these remarks to discuss the whole question

on that basis and that alone. It is undoubtedly true that the popular endorsement of the park movement in this country it is a popular movement, in a large sense is due to the innate aesthetical idea of the public desiring relief from the congestion and close surroundings of city life, yet on the completion of any park improvement in any community the larger use is by the younger people in whom the aesthetic tendency is hardly developed.

JAMES OWEN,
Consulting Engineer, Montclair, N. J.

To complete the classification, parks are of three different characters, viz: open spaces of small size, in large cities, large areas in the cities that have appropriate park development, and outlying tracts of extended size but of limited treatment, preserving the original rural characteristics. The three functions and the three characters of development are fairly in accord, and the recognition of this accord should be the governing impulse in all park development.

It may be assumed therefore that, recognizing the hygienic function as paramount, the small open spots or parks scattered throughout the area of any large city are or should be practically play-grounds as well as resting places, and the treatment in their construction should be based on that idea, varying of course with the character of the population and their habits. The elaboration of small park work with carefully graded walks and lawns with ample foliage and fences around the lawns, limiting its use by the people to walking and sitting, may be appropriate in certain conditions, but generally an open area with free scope for children to race around is surely the more popular idea of development.

In the development of the larger park areas more scope can be given

SATURDAY AFTERNOON IN TENNEY PARK, MADISON, WIS.

to systematic development of a higher order, and the aesthetic development be paramount. To that end therefore, the public mind, with inherent craving for the open air and the desire for unlimited roaming, can now be controlled within desirable limits, and every taste and sense be gratified.

The largest development of park construction in the country is based on these lines and generally the practice is fairly well defined, subject only to modification in details according to special requirements. In a cursory glance at this practice the ideas have been developed as follows: Drives, walks and lawns, with water areas, form the first basis of construction, and these should be laid out according to topography of the land and the general trend of travel. A great many mistakes have been made in park construction in laying out winding roads and meandering walks that have no finality or object. A person starting does not know where he goes or where he will get to. This may be desirable for the dilettanti or the hobo, but it is not appreciated by the American public who are always desirous of getting there, wherever "there" may be. Many parks lose a large part of their usefulness for such a reason. The ideal way is first to creat an object. This object may be a lake, a bandstand, a monument or a restaurant, the distance to the object being immaterial. Then let the walk or drive be the thoroughfare to it. Straight lines need not, in fact should not, be

THE OLD YAHARA RIVER, BEFORE IMPROVEMENT.
MADISON, WIS., PARK SYSTEM.

adhered to in such walks or drives. A little section of a drive here and a cluster of walks there may be ideal from an aesthetic point of view but the rule should be that a definite object should exist as the termination of all such thoroughfares. The ball ground will attract more people than any other object. Let the access to this be as direct as is consistent with a proper alignment. One thought occurs here and that is the actions and movements of millions of people are controlled and governed by the layout of all park development, and this movement extends to futurity, therefore it is paramount to consider the probable desires and emotions of the people in all such lay out. Another problem, also emotional, is to be found, namely the desire for short cuts. Such a desire has a tendency to concentrate travel on lawns instead of fostering the scattering idea, but probably such a difficulty can be finally eliminated in the maintenance.

Given the drives, walks, lawns and lakes the further development can be purely a matter of taste, and then we enter into the aesthetic development which of course is limitless, governed only by the ideas of the constructor and the money there is to spend. Of course the playground, the gymnasium and the picnic section are to be considered, but all these now can be treated as part of the park and true park development can be maintained. The flower garden, conservatories, nurseries and zoological section can now be located and then will come the planting and location of trees and shrubs and with the fulfillment of these items a park is now created. Of course in many localities these amplifications are not desired, and the money is not forthcoming for them. In many others various other desirable objects of interest and instruction have been created and always with satisfaction to the community.

The creation of a park is incidental but the maintenance is permanent and the maintenance problem is largely left to untrained hands and is not always in control of master minds after the creative mind has gone. It may be stated as an axiom that the maintenance of any park would be a subject of more consideration and watch-

FARWELL DRIVE, MADISON, WIS., PARK SYSTEM.

fulness than its creation. The public mind, after the interest in such creation has lapsed, is apt to become indifferent, those in control not feeling the stimulus of public watchfulness may become negligent, and what was originally a thing of beauty may without proper care and solicitation become an eyesore and really a menace. To prevent such an occurrence it is desirable now to allude to the

ENTRANCE TO OWEN PARK, MADISON, WIS.

aesthetic and educational part of a park system and what the possibilities are in that direction.

To the thinking mind no greater object lesson can be given to the average city dweller, with sordid and untidy surroundings, than the tidiness and carefulness exhibited in the maintenance of public grounds. If the older generation have not the training or time, the younger folk imperceptibly absorb these notions, and in good time in the maintenance of their own homes the influence will be felt. So let the cardinal maxim of all park maintenance be tidiness. This word is used purposely as it conveys the idea more fittingly. Of course in a purely rural park, where nature is left to its own devices the word tidiness is there only relative, as nature itself is always tidy, but in small city parks and in the larger areas a complete force should always be maintained to enforce the idea.

Incident to tidiness is the maintenance of roads, walks and lawns and keeping them in proper repair. These repairs must be continuous and incessant, otherwise an appearance of neglect will ensue and, if delayed, extra cost will be the consequence. The maintenance of lawns is always a problem, now that the idea of segregation has been abandoned and the public at large is allowed to roam at will. The tendency to concentration must if possible be obviated, and if the population is not too great in proportion to the area of the lawns no permanent harm is occasioned. Resodding or reseeding, however, is found necessary where the travel or walks lapse over on the grass. If the travel, however, is greater than the grass can stand the section affected must be closed off.

In all park systems there has to be in original construction a system of drainage on the surface and underground. This drainage is always a matter of solicitude in maintenance owing to obstruction and sometimes lack of size of the pipe. In the

newer construction and development the underground drainage is wisely being eliminated as far as is practicable. This is better, provided the surface water is not allowed to tear up the roads or sod, In rainy weather a park is not much used, so surface water is of little inconvenience.

One of the great problems in park maintenance is the proper renewal of the water in the ponds and lakes. The gathering of surface water into a pond, letting it stay there until the next rain washed some of it out, is a practice not to be tolerated. It is a detriment to health, and very often unsightly to the eye. If renewal can be obtained from a spring it is satisfactory, otherwise an artificial supply should be provided or the pond abandoned. A water surface in a park is always a pleasing feature to the eye, but it is somewhat undesirable from a hygienic point of view, and furthermore all surface water with the washing of streets and roads and lawns, should be gathered and delivered into natural drainage courses and got rid of. Where wading pools are used pure water is absolutely necessary, and should either be delivered from a spring or from the regular city supply.

In the case of flower gardens, nurseries, conservatories and zoological departments, they of course, should have special experts in charge to achieve good results, but there is one point that is often neglected in parks, and that is the proper means of identification of all specimens, whether trees, flowers, animals or birds by means of labels or tags, so that all interested parties may know their names. This is necessary for educational purposes. As to the trees and shrubs the usual rule has been in original construction to plant a great many more than will finally be desired, with the idea of thinning out the undesirable ones as the years go by, or allow for the trees dying off. It is questionable however, whether such a practice is desirable or proper. Many of the parks in our country today have too small open areas and too many trees. They did not die as expected, and the maintenance department has hesitated to thin them out, and in many instances the draft on the soil is too great and the trees themselves are becoming so restricted in their growth that none of them will arrive at complete maturity. The better practice of today is to plant more sparingly, giving each tree a better scope for growth, extend the open areas and instead of cultivating the old fashioned grouping idea let there be isolated trees or large growth with vistas between. Sunlight and shade are component parts of park development but the open sunlight should prevail. Sunlight is necessary to man, the shade is a luxury and relief. The same idea of planting should prevail in the matter of shrubs. There of course the removal is easy if the growth is luxuriant, and their shape is not apt to be deformed by closeness as with the larger trees. In the matter of inserting choice shrubbery in public parks much difference of opinion prevails, as in some localities it is claimed that the expensive and rare varieties are liable to be stolen, but the ordinary specimens are unmolested. In considering this point it may be asserted that when a community is educated so highly as to appreciate the rare varieties they are well on the road to be educated up to the point that it is better to have them left in their proper place than to be illegally appropriated. Aestheticism, when cultivated, always is accompanied with an appreciation of good ethics. That is to say, the original cause of the trouble will be its own cure, so therefore let it be strongly maintained that the greater the variety of foliage, either in trees or shrubs, the better of course the pictorial effect and the better the educational effect. The novelty of a specimen may at first attract the desire of possession, but the possession illegally must invariably be accompanied in a mind so constituted with regrets at the improper conduct.

Another question of maintenance that requires special treatment and consideration is the athletic end. The surface of a playground, the care of the gymnasium plant, the renewal of the sod on a well played ball ground, the mowing of the grass, and care of trees on the golf links are all matters that are imperative as being in the hygenic department. The athletic development of the city youth, instead of being in the corner lot as of old, is now fostered in the parks, and the result of this change is the education of the rising generation both mentally and physically to a higher plane. As a sequence the popularity of a park system is dependent on the strict care with which the athletic department is maintained. No special preference should be given to any game. All should be perfect, whether used by a

bare-foot boy on the ball ground, or the elaborately togged golf player on the links. In twenty years no one knows who will be on the top, but they will both look back to their boyhood games with pleasure and gratification.

At this point it might be proper to allude to the treatment of the larger rural parks or reservations as they are sometimes called. The maintenance of such territories of course can not be so complete or perfect as for parks proper. In Europe these parks are of aged creation and during the process of years their development has sometimes merged into that of a rural park. Such a disposition is not appropriate to the design in this country. Nature is here to have full sway, lightly guided by the hand of man. Drives or roads are constructed and walks laid out and kept in good travelling condition, but the growth of the trees should be regulated by judicious forestry, the cultivation of the open ground should be ideal farming, and game preserves can be established with little original cost and small outlay in maintenance.

A combination of the mural and rural development was effected originally in Central Park, New York., the upper end being reserved for the rural idea. The growth of the city overruled the attempt and subsequently rural parks were acquired in the annexed district. The National Government has of later years approved of the idea and large tracts in the far west have been segregated to public use for ever.

Some of them, like the Yosemite Valley, have an elaborate system of maintenance others are merely in a formative condition.

The policing of public parks is a matter of grave consideration. The line between liberty and license is hard to draw. The good judgment of a park policeman is a component part of his career. Order must of course be maintained, and such order can only be construed as the largest license to the individual without detriment to the community. The newer parks have the hardest time to maintain the desired equlibrium. In the course of years however tradition makes play and the general public, imperceptibly to themselves, acquiesce in the order of rules and very little friction or trouble ensues. The theft of shrubs or plants is a crime and should be considered as such, but generally a howl on the ball grounds is tolerable in the park even if the cynic growls in his solitude. The regulation of the use of the gymnasium plants, the wading pools, the speed of autos, bicycles and carriages are all matters of judgment and no strict rules can be given except a limit in all cases, and limit of speed, a limit of the use of the wading pools and of the monopoly of the swings must be defined by the police or his superiors, but whatever rules are formulated, impartial insistence must be maintained or trouble will insue. In the rural parks protection must be afforded to all visitors and in the dense forest the lone girl must feel a sense of protection or the value of her trip will be lost. It may be stated, however, that there is less crime, less hoodlumism in the public parks than in any other place of free resort, and to the thinking mind this is due to the uplifting influence of the surroundings.

There is one view of park development and maintenance that requires special consideration and one part of it has so far not yet been taken hold of and that is the educational feature. A city-bred boy, especially in a large city, receives his education in nature and allied studies from his books, with but little opportunity to see the real thing. A complete park development affords to the student a variety of object lessons that he will absorb in a much quicker time than mere book knowledge will give him. Think of the subjects embraced in a complete park; the study of botany including flowers, plants and trees; forestry properly developed in the rural portion; animals in the zoological department; birds; fishes in the ponds and lakes; weather from the meterological apparatus used in all well maintained parks, can also be profitably studied in a limited degree. Now with all these subjects, which are really part of the curriculum of the public school, why not let the park system be an adjunct of the school? Why not let classes in turn visit the parks under competent teachers and learn from actual inspection. The parks of the country are great educational influences, to a large extent indirectly and imperceptibly, in fact by absorption. Let this influence be extended into a practical shape, and much good will result.

A boy or girl goes to the park for the fun of it. The man or woman for rest or recreation. All are benefited, and that brings this article to the last item for consideration, viz,

the question of transportation. This is a subject that is greatly neglected in all park development. However, highly developed a park may be, and however attractive, it is of little use unless easily accessible. This accessibility should really be made a part of the original layout. Many parks have been originally built in the outlying limits of a growing city. The city has slowly built up to the park, perhaps beyond it. Trolley or steam car accommodations may be there or not. It is some one else's business to care for that. During these years the amount of patronage that a park so situated enjoys, is limited to much less than is desirable or proper. An ideal park layout ought to have public communication through it, not by stage or hack at 25 cents per hour, but for the generally accepted nickel. This can be done by constructing a trolley road in the park itself, hidden from sight if possible, but certainly with no level crossing on a drive or walk. The sunken roads in Central Park, New York, show what can be done. Nobody sees them and very few know of their existence, but what a boon to the tired mother and children would be a trolley to take them to the desired spot instead of tramping half a mile or a mile in the hot sun. This idea will be severely criticised by the conservative element of the community, but to the thinking mind the great drawback today in the use of the large park in the cities of this country is lack of transportation. The autos don't want it. The men can walk, the boys can run, but the children and their mothers want their relief.

This article was not intended as a treatise on park development, the intention being merely to allude to certain principles and ideas which are not generally perceived, and if public interest be aroused to their consideration these words will not have been in vain.

PROGRESS IN SEWAGE DISPOSAL.

Report of Committee on Sewerage of A. S. M. I.

By C. H. Rust, Chairman, Toronto, Ont.

Your committee proposes, very briefly to review the more recent investigations made in the method of treatment and final disposition of sewage. Experiments have been steadily progressing both in the United States and Great Britain dealing more particularly with the treatment of sewage upon filter beds. In Columbus, Ohio, through the efforts of Mr. Griggs, who was then city engineer and is a member of this Society, a valuable series of experiments were carried out, and as the result of these investigations the experts expressed a preference for trickling filters. The result of this work has been of incalculable benefit to engineers and municipalities. We only refer briefly to this work as no doubt the members of the Society have had an opportunity of reaching the full report upon the results of those experiments.

While a number of small places dispose of their sewage by septic tanks and bacteria beds, no large plants similar in magnitude to those at Birmingham and Manchester have as yet been installed in America. From the experience in England it appears that much better and more satisfactory results are now obtained from filter beds. Where the sewage is either distributed by revolving sprinklers, or by jets, it has been found that a much greater quantity of sewage can be treated per acre by this method than by the contact beds, and while at Columbus from the results of the experiments it has been decided to distribute the sewage by means of jets, we doubt very much this method of distribution will be a success in the more northern parts of this continent.

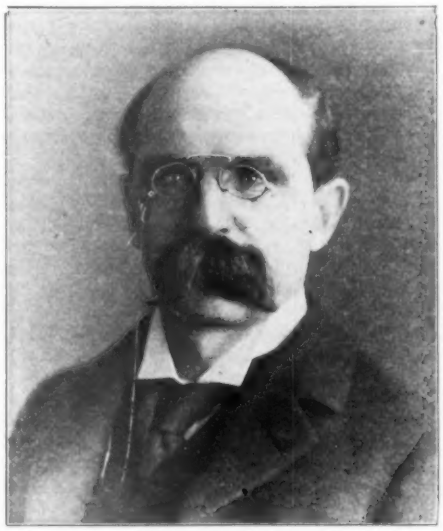
When septic tanks were introduced a few years ago we were assured that the sludge problem had been solved. This unfortunately has not proven to be the case, and while the introduction of septic tanks has minimized to a very large extent the

sludge problem, compared with the former system of precipitation, there is still a considerable amount to be dealt with.

The Chairman of this Committee last year had an opportunity to visit some of the of the more important and larger plants in Great Britain, amongst others, the Birmingham Disposal Works, situated in the Eame Valley and in charge of Mr. John D. Watson, an Engineer of very great prominence in this branch of the profession. Mr. Watson has fortunately been able to devote both time and money in experimenting with various methods of disposal. At the time of the visit the total flow of sewage distributed to the works, which constitute about 2800 acres, was 25-million gallons, of which 7-million gallons was treated in detritus tanks, septic tanks and beds. The detritus tanks were cleaned out weekly. Some of the septic tanks had been in use for two years without any sludge having to be removed. It has been considered by many engineers and others that the sludge from the septic tanks would create a great nuisance if put upon land, but this has not been found to be the experience at Birmingham, where the Chairman had an opportunity of observing large piles of this material, which had recently been deposited on the land and which was quite inoffensive. All the sewage treated goes through two septic tanks. Mr. Watson expressed an opinion that from twelve to fifteen hours is quite sufficient for septic tank capacity.

Of the various kinds of filter beds in operation upon the works, some of them disposing of 1-million gallons of sewage per acre, Mr. Watson expressed a preference for the distribution by means of jets, the beds being six feet deep and covered with six inch pipe six inches apart, and the jets are placed six feet apart in rows and operated under a head of 2 feet. Mr. Watson also expressed an opinion that not more than fifteen-million gallons of strong sewage can be purified upon the 20-acre filter beds in operation at these works. Mr. Watson is a firm believer in coarse beds and takes through some of the beds as much suspended matter as is put in them. The beds have been in use from two to four years without renewal. These beds cost about $30,000 per acre. Mr. Watson is also very strongly in favor of open tanks and is satisfied that septicised sewage can be placed upon the land without creating a nuisance. It was very pleasing to observe at Birmingham the manner in which the grounds in the vicinity of the tanks had been ornamented by means of flowers, shrubs and grass plots.

At Manchester, where formerly the sewage was disposed of by chemical precipitation, there is now in use a very large installation plant treating their sewage with septic tanks and contact beds. They have 46 acres of primary beds and 26 acres of storm



C. H. RUST,
City Engineer, Toronto, Ont.

beds, but they find that one set of contact beds does not give a satisfactory effluent sufficient to meet the requirements of the River Board, and they are now arranging to put in a secondary set of beds. The annual cost of operating these works is about eighteen cents per head of population, not including any capital charges. Between 25 and 30-thousand gallons per twenty-four hours are dealt with. The contact beds treat six hundred thousand gallons per acre. It has been found that there are from four to five grains of suspended matter in the primary beds and 1.5 grains per gallon of suspended matter in the secondary beds. It takes one hour to fill the beds and the sewage stays in one hour and empties in one hour. The

beds are filled three times per day. It is estimated that 35-million gallons of sewage yield about fifty tons of solid in twenty-four hours. It was also ascertained that the primary beds gave about seventy-five per cent. of purification and the secondary beds ninety per cent. Mr. Arden, the Chemist, also informed me that to avoid after-putrefaction they should get at least 8 per cent. of purification. For some of the beds which have been in use three or four years they have been re-washing the filtering material, which costs about thirty-five cents per ton. Mr. Arden also gave me as his opinion why the primary beds were not so satisfactory that they are not sufficiently drained.

There has been printed during the past few years an enormous amount of literature dealing with sewage disposal. Two papers which are especially interesting are the following, which were printed in the Surveyor, a London publication, one dated January 5, 1906, entitled "The Present Phase of the Sewage Question," by Mr. Reed, and the other dated July 6th, 1906, entitled "Sludge Treatment in Relation to Sewage Disposal," by Mr. John D. Watson.

The English Local Government Board requirements in regard to the capacity of proposed sewage disposal works have been very much discussed for some years, and while the Board have been subject to a great deal of criticism, it appears, after a number of years of practical experience, that their requirements, which were condemned by many as being excessive, while conservative, have been found on the whole to be fairly satisfactory. The Board, however, do not appear to have made any distinction between the variation in the character of the sewage, having always insisted upon provision in all cases of one square yard of filter one foot in depth for every 56 gallons of sewage to be treated.

We have referred in a previous part of this report to the fact that Mr. Watson found that 20 acres would purify 15-million gallons. Mr. Hart as the result of experiments at Leeds with settled and septic sewage, found that 63 gallons per cubic yard per twenty-four hours was the volume satisfactorily treated. Of course both these cases refer to the dry weather flow. The Local Government states that the volume of sewage, including rain-fall to be treated per cubic yard in twenty-four hours, is 168 gallons. At Birmingham the actual volume satisfactorily purified was 156 gallons and at Leeds the volume was 126 gallons per cubic yard in twenty-four hours. With regard to the capacity of the septic or sedimentation tanks their requirements are now considered to be too high. At first all tanks were designed to the capacity equal to one and a half times the daily dry weather flow. This was later reduced to one day's dry weather flow. A number of engineers are now satisfied that 12 to 15 hours is sufficient.

In England the Chairman visited two or three works where open tanks gave off a very offensive odor. This can probably be attributed to allowing the sewage to remain in the tanks for too long a period.

One of the largest and most comprehensive works up to the present time proposed for the treatment of sewage in the United States is in Baltimore, where in a recent report made to that city Messrs. Hering, Gray and Stearns recommend the adoption of septic tanks and sprinkling or percolating filters.

The Royal Commission on Sewage Disposal, which was appointed in 1898, have not as yet presented their final report, but have forwarded four interim reports. For the past two years, however, nothing has been heard from it. Its enquiries, however, are costing about $23,000 per annum and it is to be regretted that such an important commission have not yet been able to bring in a final report.

In the construction and design of sewers there has not been very much change during the past few years, except that the use of concrete is, we think, gradually taking the place of brick for sewers of large dimensions. A great deal more information is also required as to the size of the sewers where the combined system is in use. There is still a great deal of flooding caused by the insufficient capacity of sewers especially in cities with a large percentage of paved streets, and your Committee think that the members of the Society could do a great deal of valuable work by keeping records of the rain-falls and run-off. While a good deal of literature has been printed upon this subject we feel that further experiments are advisable.

SEWAGE DISPOSAL PLANT AT KEW BEACH, TORONTO, ONT.

By C. H. Rust, City Engineer.

That portion of the city of Toronto, Ont., known as Kew Beach is situated at the eastern limit on the shore of Lake Ontario and is solely a residential district. The level of the ground is only a few feet above the level of the lake and the soil sandy underlaid with clay. The property owners have been for some time asking for drainage, but owing to the municipality of East Toronto procuring their water supply from a point about three-quarters of a mile east of this district, and to the objection of the Board of Health to allowing crude sewage to be deposited in the lake, it was necessary to adopt the sewers and purification works as described. The drainage area of this district is one hundred and eight-five acres. containing a population of approximately 10,000 during the summer months.

To ascertain the consumption of water a meter was placed upon this district and it was found that the actual consumption per head in twenty-four hours was 16 gallons.

The main sewer is laid along the Lake front at a depth varying from 2 to 9 feet below the lake level and is constructed of 16 and 10 inch cast-iron socket pipes. All sewers from the north discharge into this sewer and at a point midway between the outfall and the summit is constructed pumping station No. 1, raising the sewage from the low level sewers from the east and north into the high level sewer which gravitates to No. 2 pumping station where the sewage is raised into the disposal works. These pumping stations are constructed of concrete and are circular in plan with a partition wall in the centre and have a reservoir space of 3,200 gallons; and each contains a duplicate set of pumps and motors, No. 1 consisting of two 5 h. p. alternating vertical motors and two 4-inch submerged centrifugal pumps and No. 2 consisting of two 7½ h. p. alternating vertical and two 4-inch submerged centrifugal pumps. Motors and pumps are automatically controlled by the rise and fall of the sewage in the reservoir.

The shafts of the pumps are connected direct onto the armature of the motors without any bevel gearing, which practically eliminates all noise whilst operating.

The disposal works consist of three septic tanks and twelve bacteria beds, constructed from plans designated by the Cameron Septic Tank Company and operated by the gear patented by them.

The works are erected on the shore of the lake about 200 feet from the water's edge, and are supported by 10-inch piles driven 16 feet through the sand and into the hard clay and surrounded by tongued and grooved sheet piling driven fourteen feet.

The construction of these works is of concrete in the proportion of seven of broken stone and sand to one of cement.

The three septic tanks are each 100 ft. x 14 ft. x 7 ft. 3 in. deep at the low end with a total capacity of 183,750 gallons. They are covered with a 3-inch concrete roof, made in the proportions of 4½ of broken stone and sand to one of cement and reinforced with 3-inch mesh, 10-gauge expanded metal. At 6 ft. 6 in. centres are 9x6 inch concrete beams supporting the roof, reinforced with ¾-inch Johnson's corrugated steel bars. An inlet channel feeds the three tanks at the high end, each one of which can be operated independently from this channel.

The distribution of sewage into the tanks takes place through one 8-inch pipe, thence through four 12-inch openings, 3 feet above the bottom of the tank, which accomplishes a maximum flow of sewage with a minimum amount of disturbance. At the low end of the tanks thirteen 4-inch outlet pipes are built into the wall, 2 ft. 7 in. below the water line, connecting with the cleansing chamber and outlet channel. From here the main effluent carrier is built into the wall of the bacteria beds in line with the outlet channel of the septic tanks and runs the whole length to the end of the beds and has three branches at regular intervals, each feeding one set of 4 beds.

There are 12 bacteria beds, 3 sets of 4 each having a combined area of 1,860 square yards. Each bed is 50 ft x 28 ft. x 4 ft. 6 in. deep and is filled 4 feet deep with furnace slag varying in size from ¼-inch to 1½ inches. On the floor is laid 14 lines of 3-inch

weeping tile collectors, discharging into a 9-inch main collector, and 6 inches below the surface of the slag are 6 lines of 6-inch weeping tile distributers fed by a 9-inch main distributer. All discharge pipes terminate in one common chamber from which a 15-inch main filtrate carrier is laid down to the lake, the last 30 feet being supported on piles.

The sewage is raised to a height of 22.5 feet at pumping station No. 2, into the inlet channel, which is below water line and extends to a point beyond the inlet to septic tank No. 3. From this inlet channel the sewage is admitted into each tank required to be operated through the submerged openings.

The effluent from the tanks flows through the submerged outlets and be filled in turn. This method of working renders the contact beds self-cleaning so that they retain their purifying power unimpaired.

The alterante filling and emptying of the contact beds is effected automatically by means of the alternating gear in the following manner: As soon as bed No. 1 is filled, a small quantity of filtered effluent overflows from its discharge well into a float chamber, lifting the float, at the same time opening the admission valve and closing the discharge valve of bed No. 2. When bed No. 2 is filled, this operation is repeated, the flow of tank effluent is diverted into bed No. 3 and the discharge valve of bed No. 1 is opened and its contents are allowed to discharge.

The construction involved the carry-

THE SEWAGE DISPOSAL WORKS AT KEW BEACH, TORONTO, ONT.

through the effluent chamber, which arrests any solid matter which may find its way through the outlet pipes in time of excessive flow and thence into the outlet channel.

The semi-clarified sewage now flows along the main effluent carrier and on to the automatic distributing gear from which it is distributed to each bed in turn through its admission valve. The discharge valve will be closed meanwhile so that the interstices of the filtering material will be filled with the tank effluent. The effluent remains in the contact beds for a period of about two hours, according to the rate of flow. The discharge valve will then open, when the filtered effluent escapes, drawing down after it a supply of air into every crevice of the contact bed. The latter will then drain and aerate whilst the remaining contact beds of the set are filling, after which it will again

ing out of 12,262 feet of 9-inch pipe; 1,569 feet of 12-inch; 1,349 feet of 15-inch; 2,451 feet of cast-iron pipe; 32 manholes and 982 junctions. The average depth of the sewers was 8 feet 9 inches. A great deal of the work was in sand charged with water involving constant pumping.

The cost of the works was as follows:

Sewers and pumping stations..	$37,755
Pumping plant	3,185
Disposal works	13,079
Piling, etc.	5,119
Slag, 2,500 cu. yds. at $1.50....	3,750
Automatic distributing gear...	4,000
	$66,888

It was found after the slag had been in the beds some time about ten per cent. of settlement took place. The works have been in operation since April and the effluent so far has been very satisfactory.

PROGRESS IN STREET PAVING AND CLEANING AND REFUSE DISPOSAL.

REPORT OF COMMITTEE ON STREET CLEANING AND REFUSE DISPOSAL OF A. S. M. I.

By Clarence D. Pollock, Chairman, New York City.

As usual, progress has been made in street paving, street cleaning and final disposition of city wastes.

Whether the increase in mileage of improved pavements will equal or exceed previous record years or not, we cannot tell until the records for the full year are compiled. However, it would not be surprising if the length of new pavements should be less than that laid in previous years as a number of our large cities have been handicapped by failures to sell bonds for improvements—for example New York and Boston.

Some cities have given more attention to the repair and maintenance of existing pavements, which seems to be a move in the right direction. There is such a thing as rushing ahead, spending all of a city's money in new pavements and often cheap pavements, and not keeping the older ones in passable repair, until a city becomes like some landowners "land poor" or in this case "pavement poor," i. e. cannot pay the taxes which here is the cost of maintenance.

The number of municipal asphalt plants, especially those for maintenance work, has been augmented. This too is along the right track. Even though it may cost somewhat more for a city to repair its own asphalt pavements, as is often argued, it would seem worth a considerable extra cost for the municipality to have complete control of the repair machinery and thus be in a position to see that all holes and openings are repaved promptly; no matter how far from the plant. Thus many damage suits may be averted and also, by no means least, the taxpayers will have full use of the pavement for its full width all the time.

Numerous cities and towns have continued experimenting with various preparations for laying the dust and preventing dust on macadam pavements. In general the cost of these methods, or rather of those which seem to accomplish the result aimed at, is apparently as great or greater than the cost of sprinkling with water, however there is the advantage of having the dust prevented at all times, while sprinkling only lays the dust during the daytime or while the sprinkling is continued. Many complaints are heard of the destruction of macadam pavements by the speeding automobiles, and attempts have been made to secure a solution or compound which may be applied to the macadam to lay the dust and at the same time to harden the surface and prevent this wear. There appears to be abundance of room for experiment on this subject.

It is encouraging to note that more portions of the country are giving up the old method of working out road taxes and are paying them in cash. This enables the town, county or state to employ men of experience to direct and superintend road improvements, and also to lay out a general system for the work.

A recently published report of data collected by the U. S. office of Public Roads of the Department of Agriculture furnishes good food for thought. Mr. L. W. Page, the director of this bureau, has displayed a great deal of energy and care in compiling this report.

Among other things he shows that in 1904 there were 2,161,570 miles of public roads in the U. S., and of these 7.14 per cent. were improved in some shape. These are outside of towns and cities. He shows 0.73 miles of road to each square mile of territory, or 1. mile of road to each 35 people. The number of people to the mile varies from a maximum in the District of Columbia of 1,459 to a minimum in Nevada of 3 people to the mile.

About $80,000,000 in labor and materials were expended in 1904 on improving the roads. When the amounts expended on pavements in cities and towns are added to this, we have a large total invested in streets and roads in the U. S. each year.

Statistics are hard to obtain and the office of Public Roads will do us a great service if this work is continued and extended. This inquiry might with profit be extended to the cities in regard to data concerning improved

pavements. It is very hard now to obtain paving data from cities in any reliable shape for comparison.

With reference to progress in street cleaning, the rate seems to be slow. Several authorities have stated recently that hand sweeping of block pavements, such as granite and the like, is still superior to any machine sweeping. All machines apparently require a smooth pavement in good surface and repair to be of any advantage. Numerous places have tried flushing machines on smooth pavements with success. New York and Brooklyn attest the fact that flushing the pavements occasionally is of great advantage to aid the cleaners in providing for flushing from hydrants in connection with the new high pressure fire protection systems.

A number of our large cities are devoting more attention to the cleaning of pavements than formerly,—notably Chicago and Boston. Boston has been examining into her cleaning system very recently with an idea toward its improvement.

In general many of our cities spend a great deal of money on cleaning the streets without proper supervision of the work. The evidence of experts would point out that we should spend money lavishly on the direction and supervision and do the saving on the lower grades of labor.

In the disposal of wastes of cities, the tendency toward keeping the wastes separate is a help in the final disposition of them,—thus clean ashes make good fill, the light inflammable wastes may be burned and the heat utilized.

CLEANING STREETS BY FLUSHING.

ABSTRACT OF PAPER BEFORE A. S. M. I.

By Frank Aldrich, Superintendent of Streets, Detroit, Mich.

For the past two years we have been flushing 1,250,000 square yards of our brick and asphalt pavement. It has been no easy matter to overcome the prejudices of many of our people to the flushing methods of cleaning streets, and some still contend that our pavements are being ruined by this method. They think that water sent onto the pavement under high pressure is loosening and tearing out the cement between the brick, and some even assert that it is very fast wearing off the brick and asphalt. I have watched closely the results from flushing all kinds of pavements, and I have found that it is not safe to flush cedar block pavement, because, too often, through the carelessness of the tar-pourers, they do not get the tar much below the surface of the street. Therefore the pressure of the water in such places lifts the tar from the gravel between the blocks and thus injures the pavement. But on brick or asphalt I have found that it is not only the best plan for cleaning, but it is most beneficial to the pavement. Whether tar or cement is used between the brick, all of it near the surface of the pavement will crack and loosen from the brick as soon as heavily loaded wagons pass over it. This is caused by the shallowness of the cement over the rounded edges of the brick. The more the edges of the brick are rounded the deeper the cement will break away, and any irregular prominence on the brick will chip off and all of this loose material will be pressed into any space below the level of the surface of the pavement. Even brooms will not remove this, but the flushers clean out all the loose matter and thus expose all the imperfections in the pavement, which already existed but were covered. Naturally any one who arrived at his conclusions from the appearance of the street just before its first flushing and then viewing it just after, might be justified in concluding that the cement had been injured, but if they will watch it week after week they will discover that the crevices are getting no deeper. Now as to the benefit derived by these pavements on account of flushing. Sooner or later in all kinds of paved streets pockets will form where sand and dirt will gather. After a rain water will stand in these holes and every wheel that goes over that wet sand grinds the hole a little deeper until in a few weeks or months there will be a pronounced chuck hole there, and if it be neglected, it will soon be down to the concrete. These depressions in the pavement are usually caused by permit gangs, who

tear up a small section of the street and then fail to put the dirt back as compactly as it should be, therefore the pavement settles. But the flusher comes along and washes all of that sand out of the depressions as well as off the smooth pavement, and the friction between the wheel and the pavement is removed.

We flush our down town streets twice a week, and the outlying streets once a week. The teams work on the flushers 12 hours, the inspectors 8 hours. We run our flushers in pairs, the inspector handling the hose at the hydrants and supervising the work. During the past summer we have been flushing about 1,300,000 square yards and sweeping 4,275,000 square yards of pavement. Our flushing has been done with four machines working night and day. The city has just purchased four more machines and we shall hereafter flush all our brick and asphalt pavements, amounting to about 3,000,000 square yards. During the summer we use about 100 "white wings" to pick up the droppings.

I am often asked how much flushing adds to the expense of cleaning the sewers. The basins have to be cleaned a little oftener, because in the immediate vicinity of the sewer opening the heavy rush of water will carry into the basins all the sand and dirt, but only the sand remains in the basin and the light dirt goes to the sewer the same as it would with the water from a heavy rain storm. When the flushing wagon gets a few yards away from the sewer grate, the sand will settle in the pavement at the curb, to be removed by the dirt wagons. I am satisfied from the investigations I have made that the small increase in the expense of cleaning sewer basins is more than offset by the benefit the sewers derive from the large volume of water which passes through them from the flushes. It cleans the sewers and carries along the waste which often remains too long stagnant in their bottoms.

Referring to the action of water on the pavement, I have lately made a test by placing brick inside of a wooden frame and slushing the crevices with the usual proportions of cement and sand. After standing two weeks I placed the brick under a stream of water which has about 30 pounds pressure and allowed the water to run onto the brick and cement for over 48 hours. This represents more washing than a pavement would receive from flushing in three years and the wear is hardly noticeable.

For about six months in the year the flushing and sweeping machines can keep the streets comparatively clean, but the flushers depend on the use of water and the sweepers must have a sprinkler precede them to keep down the dust. So the frost stops all of this kind of cleaning. Of course the dust is not as harmful in the winter as in the summer, yet it is most unpleasant to those whose business calls them on the street. We believe that a compressed air machine that will draw up the dirt from the street without raising a cloud of dust is what must come into use, and with such a machine I believe the dust problem would be solved for the whole year.

REQUIREMENTS FOR TREATING WOOD PAVING BLOCKS.

By Geo. W. Tillson, Chief Engineer of Highways, Borough of Manhattan, New York.

During the last few years wood pavements have attained considerable popularity in this country. Whether they increase or even maintain this popularity depends upon the ability of the blocks to withstand not only the action of street traffic, but that of time and the elements.

Wood has been used at intervals in street pavements for about seventy years, but never with any permanent success, if we except the present movement. This being so, it can pertinently be asked why should any better result be expected now. The answer is that there is one vital difference between the old and the present blocks, as the former were laid in a natural state while the latter are treated chemically.

Pavements wear out or rot out. If their material will not decay, the life varies according to the traffic imposed upon them. But wood in its natural condition is subject to decay and with no traffic at all will last only for a limited time. The object of the treatment then is primarily to prevent this

decay. But all wood swells when exposed to moisture and contracts when subjected to heat. But if the pores of the wood can be filled with a substance that will prevent the absorption of water it can be kept stable in size, neither shhrinking nor expanding during the varying changes in the weather. The object then of the introduction of chemicals is to prevent natural decay and maintain stability in size, so that a pavement will not bulge wet nor be full of loose joints when dry.

The question, therefore, is how can these objects be attained. It is generally admitted that the best agent for treating blocks is creosote oil. When the city of Indianapolis some eight or nine years ago began to lay treated wood pavements, it required the blocks to be first thoroughly dried and then impregnated with creosote oil weighing 8.8 pounds per gallon and to an amount equal to ten pounds per cubic foot. But it is probable at that stage of the business not enough attention was given to the character of the oil or the actual quantity used, so that the first pavements buckled to quite a serious extent. The possibilities of a perfect wooden pavement were appreciated, however, and eventually successful pavements of this character were laid.

Some time later an Eastern firm took up the matter of treating wood blocks and instead of creosote oil alone, using a mixture of fifty per cent. oil and fifty per cent. rosin, and twenty pounds per cubic foot. The first pavement of this character was laid in Boston, on Tremont Street, in 1900. I quote herewith from a letter received last month from an engineer in the Boston Street Department as to its present condition.

I have just been and looked at the wood paving on Tremont Street. About three years ago the upper end perhaps a hundred feet long, was taken up and relaid with the old blocks, with open joints about the thickness of a lath, and grouted with cement and sand, as I remember it. That portion shows wear, the joints have widened and there is some irregularity of surface. The remainder looks very well. On the part most worn, that is near the middle of the street, there is a somewhat rolling surface.

The pavement was laid in 1900, and it has worn very well indeed as a whole and is now in good, usable condition.

This is, without doubt, the best evidence that can be obtained upon this particular kind of pavement. In 1902 a street was paved with this material in the Borough of Brooklyn, New York. In addition to the above, the specifications required that the blocks, when treated, should sink in water, and after having been subjected to a temperature of 100 degrees F. twenty-four hours, should not absorb more than three per cent. of water when immersed for an additional twenty-four hours, the idea being to specify a result rather than a method only. The absorption test was considered the most important, the other being preliminary only and an indication that the proper amount of the mixture had been used. No trouble was ever experienced with pavements laid by the city under these specifications.

As the use of wood spread over the country, different specifications were adopted according to the views of the different officials. Bearing in mind the objects to be attained by the treatment, the method that will produce that result economically is the best. With the constantly increasing price of all materials used in the production of treated blocks, it is of great importance that no surplus nor unnecessarily expensive material be used. The Borough of Manhattan, New York, probably has more of this treated pavement than any city of this country, and the salient points of the specifications under which the latter portions of them was laid are here given.

(4.) The blocks are to be treated throughout with an antiseptic and water-proof mixture, 75 per cent. of which shall be creosote or heavy oil of coal tar conforming to the specifications hereinafter set forth, and 25 per cent. of which shall be rosin conforming to the specifications hereinafter set forth. All parts of each individual block shall be thoroughly treated, and not less than twenty (20) pounds of the mixture per cubic foot shall be injected.

(5.) In preparing the blocks to receive the creosote mixture, they shall be placed in an air-tight cylinder, in which dry heat, or heat produced by superheated steam, is maintained and raised to a temperature of 215 degrees Fahrenheit, for one hour, for the purpose of expelling moisture; the heat is then to be increased until it has reached 285 degrees Fahrenheit, this heat being maintained for a period of three hours, or until the block is completely sterilized. Application of heat is then to be stopped and the temperature of the cylinder allowed to fall for one hour, or until same has been reduced to 250 degrees. A vacuum is then to be applied until about 26 inches is reached, and while under this vacuum the creosote mixture is to be run into the cylinder at a temperature of from 175 to 260 degrees, after which hydraulic pressure of not less than 200 pounds per square inch is to be maintained and raised

until the individual blocks are treated throughout.

(6.) The creosote oil is to conform to the following specifications when tested, as follows:

(7.) The gravity at 68 degrees Fahrenheit shall be not less than 1.12. When distilled in a retort with the thermometer suspended not less than one inch above the oil, it shall lose not more than thirty-five (35) per cent up to 315 degrees Centigrade, and not more than fifty (50) per cent. up to 370 degrees Centigrade. The oil is to be free from adulteration; it must not be mixed with or contain any foreign material.

(8.) The resin is to be solid resin obtained from pine. It is to be reduced to a fine dust by grinding and then incorporated with the hot creosote oil in a suitable mixing tank until the proper proportions are secured.

(9.) After treatment the blocks are to show such waterproof qualities that after being dried in an oven at a temperature of 120 degrees for a period of twenty-four hours, weighed and then immersed in clear water for a period of twenty-four hours and weighed, the gain in weight is not to be greater than three (3) per cent.

(40.) Fine turnings from the block shall be placed in a suitable extraction apparatus and the oil completely extracted therefrom with ether or carbon bisulphide. The oil so extracted shall be placed in a suitable still and distilled. The portion up to 120 degrees Centigrade, consisting of the solvent, is to be collected apart. The oil shall then be distilled up to 370 degrees Centigrade. The creosote oil thus obtained must conform in all respects to the requirements of paragraph 39, subdivision 7.

(41.) The Engineer shall have tests and examinations made at the contractor's works of the materials and blocks proposed to be used, and reject any or all of such materials and blocks as he may consider not to be in compliance with the specifications. The Borough President shall appoint an inspector at the expense of the contractor, who shall inspect the lumber and other materials used in the manufacture of the blocks, and the treatment of the blocks; and he shall reject any of such material and blocks as he may consider not to be in compliance with these specifications.

(42.) The blocks will be carefully inspected after they are brought on the line of work, and all blocks which in quality and dimensions do not conform strictly to the requirements will be rejected and must be immediately removed from the line of work.

It will be noticed that the rosin used is only 25 per cent. and the specific gravity of the creosote oil is 1.12 which would give a weight of 9.4 pounds per gallon as against 8.8 pounds as in the original Indianapolis requirements.

In revising these specifications the writer modified them by specifying that the mixture used should contain not more than seventy-five per cent. of oil and not less than twenty-five per cent. of rosin, that pine blocks should weigh as much as water, black gum blocks fifty-nine pounds per cubic foot and any other kind of wood at least twenty pounds per cubic foot more than the untreated. Also that the blocks should not absorb more than three and one-half per cent. of water after having been dried for twenty-four hours at a temperature of 100 degrees Fereinheit. He also changed the wordings of the clause stating the exact method of treatment by making it general in nature so that a contractor can use any method he pleases provided that he uses the proper material in proper quantity and produces a specification block.

The words "not more" and "not less" were inserted because the author believes that with a correct proportion or rosin and oil there will be no trouble in making a block that will fill the requirements of the specifications. The weight requirement was made so as to ensure as certainly as possible that at least twenty pounds of the mixture is used. This is probably approximate only but undoubtedly useful.

The writer was probably the person who first proposed the absorption test and the preliminary drying was not only intended to drive off some of the contained moisture, but also to test the volatility of the oil used, and the idea was to subject it to a temperature that would produce a result equal to actual use. It was also believed that an absorption of 3½ per cent. was sufficiently severe.

In order to ascertain the present practice the writer has compiled from the specifications of the following cities the salient points regarding treatment and tests.

The table represents the general practical differences of the cities in this country and can be considered as representative requirements.

It will be noticed that all of the specifications require creosote oil, and Indianapolis is the only one that does not require it to be mixed with something else. The Brooklyn specifications vary a little from the others in that they allowed as a substitute for resin "or any other suitable waterproofing material." One contract was laid with material other than resin and up to the present time, although only three years have elapsed, the pavement has been satisfactory.

It should be the object of all engineers to reach the desired results in as economical a way as possible, and if 25 per cent. of resin is as good as 50 or, if none at all is necessary,

City	Mixture: Character	Mixture: Pounds per Cu. Ft.	Mixture: Specific Gravity of Oil	Kind of Wood	Tests: Weight	Tests: Absorption
Boston	Creosote oil 75 Resin 25	20	1.12	Long leaf yellow pine Southern black gum		3
Borough of Brooklyn	Creosote oil 50 Resin 50	20		Long leaf yellow pine	Greater than water	3
Indianapolis	Creosote oil	20	1.12	Long leaf yellow pine		
Minneapolis	Creosote oil 50 Resin 50	16	1.09	Long leaf yellow and Georgia pine; Norway pine; Washington fir; Tamarac		
Borough of Manhattan	Creosote oil 75 Resin 25	20	1.12	Long leaf yellow pine; Southern black gum; Norway pine; Tamarac		3

it should be left out as the addition of the resin makes quite an increase in the cost. It will be noticed also that all the cities but Minneapolis require 20 pounds of material per cubic foot where Minneapolis calls for only 16. Of course, if 16 pounds are as good as 20, there is no necessity for putting in the extra 4 pounds.

It will also be noticed that while the specific gravity of the oil called for in Boston, Indianapolis and the Borough of Manhattan is 1.12, no specific gravity is given for Brooklyn and Minneapolis calls for 1.09. It can be said regarding the Brooklyn specifications that they were made several years ago when the question of the oil was not as well understood as it is at present, and no wood block has been laid in Brooklyn for the past three years.

The question of the kind of wood also makes a difference in the treatment. All of the above specifications allow long leaf yellow pine; three allow Southern black gum; and the Minneapolis allow, in addition, Norway pine and tamarac while Minneapolis also permits Washington fir. It can be easily understood that black gum, tamarac or fir, woods that contain no pitch of themselves, should require a different treatment than yellow pine. It will also be noticed that the only test specified for the blocks after they are treated is that Brooklyn requires the blocks to be heavier than water and Boston, Brooklyn and Manhattan require that they shall not have an absorption of more than 3 per cent. of water after having been dried for twenty-four hours and then immersed in water for an additional twenty-four hours.

The question of the specific gravity of the creosote oil is very important and in order to learn something about the difference in the volatility of oils of different specific gravity, a test of evaporation was made by the chemist of the Bureau of Highways, Borough of Manhattan, with the following result:

The experiment was carried out as follows: Approximately 50 grams of each oil was placed in an open cylindrical vessel having a diameter of 3 inches and 1¼ inches high. The oil was then subjected to a constant temperature of 120 degrees Fahrenheit for a period of fifty days, the oil being frequently weighed as shown in the table below.

Four samples of oil were selected for these tests—two having a light specific gravity and two heavy oils. These oils, when subjected to distillation, had the following constitution:

	Creosote Oils		Distillate		
No.	Specific Gravity	To 315° C Per Cent.	315°-317°C Per Cent.	Total to 370° C Per Cent.	Residue Per Cent.
S— 997	1.055	82.5	8.5	91.0	9.0
S—1003	1.180	33.4	13.4	46.9	53.2
S—1008	1.065	83.1	8.5	91.6	8.4
S—1017	1.190	35.4	10.9	46.3	53.7

The amount in weight which these

oils lost when maintained at 120 degrees Fahrenheit, in the number of days indicated, is shown in the following table:

CREOSOTE OILS.

Loss in Weight at 120 deg. F.

No. of Days.	S-997 Sp. Grav. 1.055 Total Loss Per Cent.	S-1003 Sp. Grav. 1.180 Total Loss Per Cent.	S-1008 Sp. Grav. 1.095 Total Loss Per Cent.	S-1017 Sp. Grav. 1.190 Total Loss Per Cent.
1.	13.3	6.2	10.9	3.8
2.	20.2	8.1	18.2	5.7
3.	26.8	10.7	24.2	7.4
6.	41.1	13.3	39.1	9.9
10.	53.1	16.0	49.7	12.1
15.	58.9	18.1	54.4	15.0
22.	63.4	19.1	59.1	15.8
29.	67.0	19.6	61.9	16.2
36.	69.1	20.3	64.1	16.7
43.	70.9	20.8	66.1	17.3
50.	72.3	21.2	67.5	17.6

It will be noted that there is a great difference in the evaporation of the oils both under high temperature and also the extended test of fifty days. Under the fifty day test, subject to a temperature of 120 degrees Fahrenheit, the oil with a specific gravity of 1.055 lost 72.3 per cent. of weight while the oil with a gravity of 1.19 lost only 17.6. It must also be understood that a so-called creosote oil, with a specific gravity of 1.19 is an entirely different material from one with a specific gravity of 1.055; and it is questionable if, with the heavy oil, it is necessary to have the 50 per cent of resin or any at all. In fact, a great many engineers contend that the addition of the resin is injurious rather than beneficial. The object of the resin, theoretically, is as much, if not more, to preserve the creosote oil and maintain it in the blocks as it is to act as any preservative itself.

Referring to the different kinds of wood, the writer believes that it would be difficult to obtain an absorption of 3 per cent. or less with any of the non-pitch woods with so small an amount of oil as 20 pounds per cubic foot. A sample of black gum that had been kept in an office, under the ordinary temperature, for a year or more, that had been treated with 40 pounds of oil per cubic foot, was tested for absorption, under the usual conditions, and absorbed less than 2 per cent. of water.

All engineers will probably agree that the yellow pine wood of itself is the best material that can be used. But this material is growing scarcer and more expensive every year and the government officials have been making experiments for some years with the idea of obtaining other woods that would be equally as good, if possible. If, however, in order to get good results it is necessary to use more oil than with the pine, it might bring the cost of the cheaper woods equal to the cost of more expensive woods after both had been treated.

The 20-pound treatment will cost approximately 45 or 50 cents per square yard for the mixture, and if an additional 20 pounds are added, it, of course, increases the cost directly that amount. So that, at the present prices, with the same treatment, black gum has an advantage over the yellow pine of about 45 cents per square yard. This difference, however, might be more than overcome by the durability or, rather, lack of durability of the wood under traffic. Black gum has been used to quite an extent recently in Boston but not long enough to obtain positive results.

After the proper treatment has been decided upon for the blocks, the question of how the engineers shall determine whether the specifications have been carried out or not is very important. It is a simple matter to see that the mixture has the proper specific gravity and, if resin is used, that the proper amount is added. The quantity of blocks put in the retort can be ascertained and the proper quantity of mixture used so that the blocks will average the proper quantity per cubic foot. Of course, it will be impossible to be sure that each block has the required amount. When it comes, however, to applying the absorption test and the weight of the block, if that be specified, another question comes up, that is, whether the blocks shall be tested at the works when they are just completed or at some subsequent time when delivered on the street, which may be some weeks or, very probably, in some cases, months. The contractors claim that the test should be made at the works and, if satisfactory, then they should be accepted at any time afterwards.

As the blocks are to be used in the streets for years, it would seem that they should be treated in such a way that they would stand the required test even if not used for several months after having been treated, especially if heavy oils have been used and in the light of the experiment noted above. The heaviest oil lost,

approximately, 18 per cent. after having been subjected to a temperature of 120 degrees for fifty days, which is an extremely severe test and one never possible to be reached on the street. If a block had been treated with 20 pounds per cubic foot and had lost 18 per cent. it would still have 16.4 pounds per cubic foot of the original mixture, which is more than the original requirements for the Minneapolis specifications. It would seem, therefore, to the writer, conclusive that the blocks should conform to the specifications when delivered on the street and not when treated.

The requirement for sinking in water, which was inserted in the Brooklyn specifications, was used more to give a quick test than for anything else, and it was found that in the pine blocks which were treated with a material that contained 50 per cent. of creosote oil and 50 per cent. of some other suitable material, almost every block that would sink in water would conform to the requirements in regard to absorption. This, however, in later experiments has not been found to be true and, in many cases, blocks that would sink in water have not conformed to the absorption test. This may have been because the blocks were heavier originally, they did not take the treatment and absorb as much oil as the other blocks and that when immersed in water, would absorb more water. This is wholly speculative, however.

The writer believes that the question of treating wood paving blocks is one that is being investigated more at the present time than any other one kind of pavement as he has received many inquiries regarding it during the past season. He also believes that it is a matter that neither engineers nor contractors have any positive knowledge of at the present time, and thinks it of great importance that the different cities investigating the matter should, in some way, give each other the result of their different investigations so that in the end all cities might arrive at a good and satisfactory specification.

The question of testing the blocks is one of great importance and it is absolutely necessary to arrive at some method of making the tests that will be as nearly positive as possible and perfectly satisfactory. And the object of writing this paper has been, not so much to give information as to seek it and, if possible, to bring about the consummation above mentioned, that is, the getting together the ideas of the different engineers of the various cities and finally reach a result that will be satisfactory to all.

BACK FILLING TRENCHES.

By George C. Warren, Boston, Mass.

It is pleasing to note that recent issues of engineering periodicals have devoted prominent space to this matter, which is both one of the most important and one of the most neglected matters which municipal officials and contractors have in connection with street work.

One of the articles referred to quotes from specifications of the West Park Commissioners of Chicago, which are incorporated in permits granted for making excavations in streets to reach underground service pipes. From the quotation, the following extract is of special interest.

All material excavated from any trench under paved roadways must be removed from the boulevard, said trench being refilled with clean cinders, sand, gravel or crushed stone, placed in layers not exceeding six inches in depth, thoroughly compacted with heavy hand rammers, using the necessary amount of water to complete perfect consolidation of the back filling.

This specification is on the safe side, but for general use, it seems unnecessarily severe and expensive in the requirement that all material excavated from any trench must be removed from the street and replaced by cinders, sand, gravel, crushed stone, etc.

I refer to the removal of excavated material from the street regardless of location of work or character of material "excavated from any trench." In the case of West Chicago Park Boulevards, such a general stipulation may be justified by either:—

(a) The importance of not littering the Boulevards any more than absolutely necessary, or

(b) The knowledge, if it is a fact,

that the sub-soil underlying this section of Chicago is such that after once disturbed it is unsuitable for back filling of trenches. Whatever may be the reason and justification for such a claim by the Chicago West Park Commission (probably justified there) this is not a general provision suitable for all cities and all classes of sub-soil. I do not want to be understood as advocating withdrawal of the greatest precaution and care in the important matter of backfilling of trenches, carelessness in which is costing hundreds of thousands of dollars annually, in damage to pavements and vehicles. My purpose is to point out the importance of the matter and to suggest practicable, general requirements for overcoming the difficulty in the most economical way in each particular case.

With a quarter of a century experience in street paving throughout the United States and Canada, I believe I have met the matter of back filling of trenches in about all of its possible phases, and I appreciate that it is most difficult to draft a specification which will give:

(a) Efficient results.

(b) A basis of payment which will insure the greatest economy to the City and fairness to the contractor.

The greatest difficulty is that the method of treatment and its cost vary widely with the character of sub-soil, which often varies greatly within the limits of a single sewer or water or gas pipe trench. This cannot often be foreseen, and it often varies with the weather conditions (wet or dry) which happen to prevail.

Before attempting to offer a solution I will mention a few instances known to me. There is a popular notion that trenches should be allowed to settle for a year before paving and that then it is safe. This is not only a fallacy which breeds carelessness in cases where it is thought no pavement will be laid in a year or more, but it is impracticable to defer paving a year or more after all mains and house connections are made and equally impracticable to avoid cutting into pavement for installation of and repairs to service pipes. We all know that by careless or indifferent back filling of trenches unpaved streets are often rendered dangerous and nearly impassable for years. I remember about fifteen years ago an instance in one of our older cities where an asphalt pavement was being laid replacing an old cobble pavement. The cobbles and a few inches of the underlying earth necessary to provide the sub-grade were removed; the sub-grade rolled with steam roller and concrete foundation laid. While the concrete was setting there was a good deal of rain. At one point in the street the concrete settled and developed a hole into which a hoe handle was inserted the full length without finding the bottom of the hole. Investigation and subsequent examination developed a serious hollow several feet down about two feet below the surface and over two hundred feet long, over a sewer which had been laid twenty-five years before and doubtless back-filled in the general customary way of merely throwing the earth loosely back into the trench. In this case a crust or arch of solid earth had become formed which did not develop the hollow below until the excavation for the new pavement removed a part of this crust and the rains caused the balance of the crust, in one spot, to fall into the hole.

In another instance no trouble developed in the construction of an asphalt pavement laid on concrete foundation, but three years later a horse's hoof broke through the surface of the pavement and he broke his leg. Examination revealed a hole six feet deep, which it took fifty loads of earth to fill, over a sewer trench ten years old. It is very common for a pavement to settle a year or more after laying it over a sewer trench, filled several years before the pavement, where no trouble developed during the rolling and laying of the pavement. It is still more common to find almost insurmountable difficulty, while the paving is in progress, from settlement of old trenches. So much for the theory that however carelessly a trench or other fill is made it will settle itself within a year. On the other hand, I have never known of a case where trouble has followed from the settlement of sewer or service pipe trenches made immediately before the laying of the pavement where I had supervision of the backfilling, even with treacherous soil conditions.

I would far rather guarantee a pavement laid immediately after a sewer trench, the filling of which I could control, than five years after the laying of a sewer, the trench of which was filled with the generally customary carelessness and usual view only to least possible cost.

About two years ago I was going over a street about two miles long in

the Middle West, for the paving of which bids were about to be received. A sewer, the trench of which was from 15 to 20 feet deep in a clay soil, was being built, using an excavating machine which back filled without tamping. On account of the looseness of the fill the level of the roadway over the trench was being raised about 18 inches, sloping to near the edge of the road. An inspector was standing over the work and I asked him to show me the specifications. They clearly pro-

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vided for "thorough tamping of the trench in courses, not more than 6 inches." On calling the inspector's attention to the provision he first claimed that it only referred to paved streets. I showed clearly that this was not the case and explained that my interest in the matter was as a bidder and possible contractor for the pavement to follow, and received the following retort: "You don't shuppose Misther Murphy (naming the contractor) is going to fill the sewer for youse." The outlet of the same sewer passed through a paved street which I found was actually being filled without any tamping whatever with tip carts loaded from the excavation by buckets and hoisting engine. An appeal to the Engineer brought a promise to investigate. A continuation of the trouble and further inquiry brought out the explanation that this provision of the specification was not generally complied with; that contractors did not figure on doing so; and that it would be a hardship to force him to the expense, and that as the pavement would not be laid for a year, the trench would probably be settled by that time. This is only a somewhat aggragavated case of what happens in fully three-fourths of the sewer trenches which are built.

Now, for the remedy, which is more difficult than to call attention to the common faults.

In the case of permits to service corporations, plumbers and property owners, to cut into the streets, whether paved or unpaved (the former is but little more important than the latter), it is only necessary to stipulate in the permit that "the trenches shall be back filled by such means as the City Engineer may direct, depending on the character of the excavated material, in such a manner that all excavated material shall be replaced in the trench without raising the grade of the roadway. Flushing will only be permitted in cases where the subsoil is sand or gravel or other material from which the surplus water will readily drain away, and in the case of concrete or brick sewers or pipe sewers, the joints of which have been made water-tight with bituminous pipe-jointing cement."

A prominent contractor who had a large experience in sewer construction and one who takes the greatest care in the execution of his work, has recently written me as follows:

> In pipe sewers, no puddling of ditches should ever be allowed, for it is impossible to prevent the water getting through the joints of the sewer pipe, and it is very likely to cause settlement in your pipe, thus breaking your cement joints. Some 20 odd years ago, in Somerville, Mass., I took the most extreme pains in having joints cemented, leaving a stretch of ditch for some few hundred feet open until the cement had thoroughly set. I personally examined every joint to see that it was a good job. We then filled the ditch, and after it was about half filled, the water was turned into the ditch from a hydrant. In a short time the 8 inch sewer pipe at the manhole at the lower end was running half full.

In criticism of this proposed requirement references may be made to the volume of the pipe. My reply is that except in trunk sewers (which do not apply to permits referred to), the volume of the pipe is so little in comparison to the volume of the trench as to be insignificant. It is well known that more earth can be tamped into a trench than is removed from it. In my judgment the only case where the rule of "get back all the dirt" cannot

apply is in rock excavation, in which case the breaking up of the rock nearly doubles its volume and the particles of rock are so large that they cannot be replaced to their original density.

In the case of contract work for sewers, etc., the case is more difficult in view of the necessary uncertainty of conditions to be met under ground, and consequent uncertainty of the most ecomomical way to properly "back fill" the trench and consequent impracticability of the contractor accurately figuring in advance what the cost "per lin. ft." will be. On this account some contractors are sure to bid far too low to permit proper work. Others figure "safe" with the probability that if they receive the contract, the total price will be too much above the estimated cost. In one case the city has the almost impossible task of forcing the contractor to do proper work at a loss. In the other case the city will pay too much for the work. An effort should be made to avoid both evils.

My suggestion is to apportion the prices in such a way that whatever material is encountered a fair price will be allowed the contractor for each as follows:

(a) Furnishing and setting pipes per lin. ft.

(b) Earth excavation per lin. ft. (providing for varying prices for varying depths of sewer.)

(c) Rock excavation per lin. ft. (providing for varying prices for varying depths of earth.)

(d) Hauling excavated material to spoil bank (if unsuitable for back filling and its removal directed by the Engineer) per cu. yd.

(e) Lumber delivered on work (if any is required for shoring) per M. B. M.

(f) Placing and replacing (if lumber reused) in sewer trench per M. B. M.

(g) Refilling trench if back filled by flushing earth excavated from trench per cu. yd.

(h) Refilling trench if back filled by tamping earth excavated from trench per cu. yd.

(i) Refilling trench if back filled by flushing suitable borrowed material (to replace unsuitable excavated material drawn to spoil bank by order of Engineer) including furnishing the material per cu. yd. measured in the wagons as material is delivered.

(j) Refilling trench if back filled by tamping suitable borrowed material (conditions the same as item "i") per cu. yd.

(k) Refilling trench with rock excavated from the trench per cu. yd.

Corresponding with such a schedule of prices in proposal and contract, the specifications should provide as follows:

1st. Material excavated from the trench, which in the opinion of the Engineer is unsuitable for back filling, shall be hauled by the contractor to a spoil bank and shall be paid for at the price bid per cu. yd. for "hauling excavation to spoil bank," measurements to be made in the wagons at point where loaded.

2nd. Flushing in back filling will be permitted only in case the material is sand or gravel or other material, from which in the opinion of the Engineer the surplus water will readily drain away and leave the earth filled solid.

3rd. Except where flushing is directed by the Engineer, the back filling shall be done by thorough, hard tamping in layers not exceeding six (6) inches in depth. Flushing will not be permitted except in cases of brick or concrete sewers or pipe sewers, the joints of which have been made water-tight with bituminous pipe jointing cement.

4th. Whether back filling of earth is done by flushing or tamping the full amount of material excavated from the trench less the volume of the sewer shall be refilled into the trench without raising the grade.

5th. In case rock is excavated from the trench, it shall be back filled by carefully placing the excavated rock in layers with succeeding layers of earth well flushed into the voids between the pieces of placed rock.

6th. In case the excavated material is clay, which in the opinion of the Engineer is too wet to enable solid back filling by tamping, the excavated wet clay and reasonably dry "borrowed" earth shall be tamped into the trench in succeeding layers, using enough of the dry earth to overcome the excess of water in the clay and to provide a solidly filled trench to the satisfaction of the Engineer. The "borrowed" earth including tamping to be paid for per cu. yd. of "borrowed material" tamped into the trench. Measurement of the borrowed ma-

terial is to be made in the wagons as delivered on the work.

If anyone thinks these requirements are complicated the answer is that the conditions are necessarily complicated. None can tell in advance the conditions of materials to be excavated and the treatment they should receive in back filling. The simple and incomplete specifications and the method of payment generally adopted in the past, have resulted in general unsatisfactory results. Requirements should be provided which will correct the evil of poorly filled trenches, however complicated they at first appear.

Of course it must be expected that the cost of efficient and proper back filling of trenches will be much greater than the cost of the inefficient system generally in vogue. The increased cost will be nothing compared with the saving in repairs to road surfaces and vehicles.

A prominent engineering paper which makes a specialty of earth work published a series of tables of interesting and complete cost data collected and tabulated with very great care. One report of twenty-six jobs on sewer sections in one city aggregating 8882 lin. ft. shows an average cost of back filling the trenches of .0722 per cu. yd. The soil is generally reported as good clay and that back filling was done by hand shovels. It is well known that this is a very low average cost of bare shovelling of earth under the most favorable conditions, so that the back filling must have consisted of loose shovelling of the earth into the trench. What about the condition of the roadway, whether paved or unpaved, following this shoddy work and what about the vehicles which have to pass over nearly two miles of this street during the next few years?

Referring to the provision above for paying for the excavation of sewers per lin. ft. with varying prices for varying depths of sewer. It will be appreciated that at depths exceeding 8 ft. the cost of excavation in sewer trenches per cu. yd. increases very rapidly. With increased depth of sewer it requires quite complicated calculations to estimate the number of cubic yards of material excavated. The suggestion, therefore, is made for paying for excavation per lin. ft. of sewer of each size and of each depth. If, therefore, the sewer has varying depths and varying sizes of pipe, not only should separate prices per lin. ft. be taken for each size of pipe, but also for each increase over 8 ft. per ft. of depth of sewer. This method of payment for the excavation or trenching not only overcomes the necessity on the part of the Enginer, and consequent general delay in payment for the work, of complicated calculations of the amount of earth excavated but it also removes all possible dispute between the contractor and the engineer in case the plans are changed, either increasing or decreasing the depth of sewer, which changes are often made necessary. If, as is the general custom, payment for excavation or trenching is made either per lin. ft. or per cu. yd., without reference to the depth, the contractor can justly complain and will be sure to do so on the ground that not only is the amount of work being increased but the cost per cu. yd. of earth removed is being increased by reason of the increased depth. With this condition and no provision in the contract for variation of prices to meet the condition, there is pretty sure to be a dispute between the contractor and the engineer as to the proper method of payment for the additional work. An important feature in all contract work is to, as far as possible, provide a unit of price in the contract for every contingency which may arise.

An important point, not referred to above in connection with repaving over sewers trenches on paved streets, is the matter of foundation. Even with the greatest care in back filling a trench, it should be reinforced at the top by a solid Portland cement concrete foundation for the pavement. The concrete should extend over the edges of the trench about six inches on each side.

One engineering journal recently suggested that tamping the earth in back filling trenches be done with pneumatic or steam rammer. This offers food for the inventor. For the present tamping must be done by the hand. The common bad practice, where there is even a pretense of tamping, is four to six shovellers to one tamper, with the weakest man in the trench because his work doesn't count in the amount of trench back filled. A good rule is to put two men with heavy rammers in the trench for each shoveller outside. Put the best man at tamping and satisfactory results will follow.

REQUIREMENTS AND TESTS FOR QUALITY OF PAVING BRICKS.

By J. W. Howard, Consulting Engineer, New York City.

Because many cities have difficulty in obtaining durable paving bricks, city engineers and others have often asked me to state from the experience of my pavement testing laboratory, in which all kinds of paving material, asphalt, wood, bricks, etc., have been tested for many years, and from inspection of brick pavements in use, what requirements and tests, if inserted in specifications, will insure a city obtaining the most durable grades of paving bricks; provided, of course, the samples submitted for use and the subsequent deliveries of bricks, are regularly tested by standard, uniform methods and by an experienced, unprejudiced engineer in a properly equipped laboratory.

The worst enemies of brick pavements are bad paving bricks. There are many cities suffering from having used paving bricks which soon became chipped, broken and uneven from the effects of weather and traffic, simply because those cities did not insert in their specifications proper requirements and tests for the bricks to meet before use. We all know that the location of some cities near poor paving brick works, cheap bricks, failures to test bricks, as well as influences outside of the control of engineers, cause many cities to use bricks which are deficient in durability. Moreover careless and improper culling or selection of good bricks from each kiln, even at works which have shales suited for making the best grades of paving bricks, too often permits bad bricks to be mixed with good ones.

Many brick plants have not the right kind of clay or other material to make the most durable paving bricks. Very few fire-clays are suited for making paving bricks. Only those impure fire-clays which contain a large amount of fluxing or annealing minerals, make paving bricks worthy of consideration. Even then it is seldom, if ever, that fire-clay paving bricks are as durable as the best grades of paving bricks made from suitable shales. In making this comparison I assume that the mechanical operations of manufacturing both classes of bricks are equally well done.

A complete chemical analysis of the fire-clay, shale or other material in the dried, unburned brick or of a finished brick, will clearly show whether or not the material can be made into a high grade paving brick. It reveals what fluxing or annealing minerals are present and if in proper proportions.

There are certain definite, physical requirements and laboratory tests which, if they are all applied to samples submitted for use and to the various shipments of bricks before use, will protect a city against bad bricks and insure the use of good bricks. I omit reference to the proper foundation, laying pavements, etc., as not germane to the selection and testing of bricks.

An experience of many years, testing thousands of samples of about 165 makes or brands from different parts of the United States, and observing their successes or failures on streets of cities, makes me conclude that the requirements and tests of quality given below, will practically eliminate the use of bad and help obtain good bricks.

The small brick size is seldom used. The larger, or block size, is best for several reasons, especially because there are less joints to wear.

The following is not intended for a complete brick pavement specification, but is a portion which can be inserted in such specification.

The requirements and tests for paving bricks for use under the specifications of which these requirements and test form a part, and which the bricks must conform to, are as follows:

(a) Samples. Paving bricks of block sizes must be submitted by the bidder and must be twelve (12) in number, properly boxed for sending by express to a testing laboratory or elsewhere. The box must be marked with the name of the bidder and date of bidding. Subsequent samples must be furnished by the bidder and be permitted to be taken by the proper representative of the city from subsequent shipments of blocks, before the use of each shipment for paving on the streets under contracts of which these specifications form a part. The proper representative of the city, in case of doubt may also select a reasonable number of sets of samples of twelve (12) blocks each, from pavements constructed under these specifications.

(b) Requirements and tests may be made of each kind or brand submitted by the bidders before awarding contracts, and are to be made at suitable intervals on samples taken from shipments of bricks before their use in the pavement. The samples can be taken

from the cars or boats on arrival, or from piles adjacent to the location of the work or from the pavement. The tests shall be made by standard machines and uniform methods and by a competent and experienced man, and if possible in a regularly equipped laboratory.

(c) The size of bricks shall be what is known as block size and shall not vary more than one-quarter inch (¼") in any block. The preferred size shall be 8½"x3½"x4" exclusive of all lugs or projections; but bricks of other dimensions may be accepted for use, provided the depth is four (4) inches.

(d) Projections or lugs are required and must be either be the name of the brick on it or other suitable projections of about one-eighth inch (⅛").

(e) The brand or mark of the brick, to identify it by name or other-

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wise shall be on each brick. No blank bricks will be allowed to be used.

(f) The shape of the bricks must be uniform, regular and must not be distorted more than one-quarter inch (¼") from the straight edge laid in any direction on them. Edges must be rounded. Repressed brick only shall be used.

(g) The material of the bricks must be homogeneous, uniform, free from laminations, cracks and voids. Only very minute fire checks will be allowed. The material shall be thoroughly annealed, fused and vitrified to toughness without excessive brittleness.

(h) The color of the exterior of the bricks shall be chocolate, light or dark brown or red, or a blending of these, and the interior shall be the same or a blending of the same colors. All bricks in any one pavement must be of the same shade.

(i) Abrasion or rattler test must be in the standard rattler and by the method of the National Brick Manufacturers Association and American Society of Municipal Improvements. The maximum loss of any one brick shall not exceed eighteen percent (18) of its original dry weight. The average loss of all bricks tested at any one time must not exceed fourteen percent (14). The standard abrasion machine or rattler is a cylinder of fourteen staves or sides, one-fourth inch (¼") apart, inside diameter 28 inches, length 20 inches, no interior shaft, revolving at 30 revolutions per minute for one hour, containing a charge of 300 lbs. of foundry iron shot of two standard sizes; and the charge of bricks for a test must approximate 1000 cubic inches which is about nine (9) bricks of the block size. Record of each brick in each test must be kept.

(j) The modulus of rupture or cross breaking of any one brick must not be below 2500 pounds. The average of all bricks tested must not be below 2700 pounds by the regular formula: M equals (3WL) divided by (2AD). in which L equals 6 inches between supports. W equals breaking pressure. A equals area of cross section at break. D equals thickness of brick. The bricks shall be tested on the side and the pressure applied half way between the supports. At least three bricks must constitute this test.

(k) The absorption of water, by any one brick, shall not be greater than three per cent (3). The average absorption of all bricks tested shall not exceed two per cent (2) of their dry weight. The absorption tests shall be made upon either abraded or on broken bricks by drying them for twelve hours in an oven and then soaking them for twelve hours in water. The increase in weight due to water absorbed, divided by the weight of the dry brick, gives the per cent of the water absorbed. At least three bricks must be used for this test.

(l) The density or specific gravity must be determined of the material of the brick, exclusive of its porosity, and no brick snall have a density of less than 2.30 and the average density of all bricks tested shall not be less than 2.35.

(m) The hardness is determined by Moh's scales for minerals in which 100 is the diamond. The hardness of any brick must not be less than 60 and the average hardness of bricks tested must not be less than 65.

(n) Crushing resistance must not be less than 7,500 pounds per square inch for any brick, and the average resistance to crushing of all bricks tested must not be less than 8,500 pounds per square inch. The crushing tests must be made on about one-sixth middle sections of bricks with pressure applied in the direction of the whole thickness of the brick, which is the least dimension of the brick. At least three bricks must be used for this test.

(o) Chemical tests may be made at the option of the city engineer or other authorized city official to determine if there are any water-soluble substances, as free lime, potash, soda, etc., in the bricks, and if present to more than a trace the entire lot of bricks, from which the samples have been taken, shall be rejected.

(p) Records of tests of each individual brick of each test, signed by the person or persons who made them, must be kept on file by the City Engineer or other proper official, during the continuance of the contract, and must be open to inspection of all persons financially interested in the contract

and to such other persons properly authorized to inspect these records.

(q) Brands or makes of bricks previously used in pavements in this city may, at the option or permission of the proper official, be used by contractors for new pavements, without submitting samples of said brands in connection with their bids; provided the bidders state the name of the brand or make of brick or block he will use, and provided the said brand or make shall have previously met all the requirements and tests above mentioned, said tests having been made by or for the city and records thereof found in the proper files of the city. This provision does not relieve the contractor nor city from having all shipments of brick or blocks regularly tested before use in pavements, as provided for by these specifications.

It is with pleasure that I present the foregoing requirements and tests for the best grades of paving bricks, for use of members of the American Society of Municipal Improvements in the many cities where they live, as well as by such other persons who may desire to use them. The cost of such tests is very small. It is practically a great economy, because every dollar paid for efficient tests in advance saves several hundred dollars sometimes thousands in early repairs to poor pavements. Samples of bricks and other paving materials are easily sent by express to laboratories especially equipped to test them. The results are quickly reported to the City Engineer or other official who thus seeks to provide his city with the best possible paving materials whether brick, asphalt, bitulithic granite, etc, each in its proper place and laid after regular tests and under proper inspection during construction.

THE GUARANTEE CLAUSE IN PAVING SPECIFICATIONS.

Its History in Chicago, Ill.

By John B. Hittell, Chief Engineer of Streets, Chicago, Ill.

Prior to 1898, the city of Chicago, in order to guarantee the fulfillment of the maintenance clause in its street paving contracts, in addition to a personal surety of fifty per cent. of the amount of the contract, retained, upon the completion of the work, five cents per lineal foot of curbing, which was to be paid back in two equal annual installments and twenty cents per square yard on asphalt, brick and granite block pavements, a one-fifth part of which was to be paid back yearly, or until the expiration of the guarantee period of five years. On cedar block and macadam, there was retained six cents per square yard, which was returned in two equal yearly payments, the guarantee period being two years.

In the latter part of that year, the specifications were revised, requiring Portland cement in the construction of the concrete foundations for asphalt, brick and granite block pavements, and the guarantee period extended to ten years; and as a guarantee a surety bond was accepted in the sum of fifty per cent. of the amount of the contract, and the cash retainer was no longer required. With but one exception, all the contractors who had previously done work under a 5-year guarantee were bidders on the work under the new conditions. The guarantee clause, as then inserted, was as follows:

It is hereby understood and agreed that the material furnished and used and the workmanship employed in the construction of the said pavement shall be of such character and quality as to insure the same to be free from all defects, and in continuous good order and condition and satisfactory to the Board of Local Improvements, ordinary wear excepted, for a period of ten years from and after the completion and acceptance of the same; and as a guarantee of the faithful performance of these specications, the quality of the material furnished and the proper construction of said improvement, the contractor or contractors hereby agree to keep and maintain the said improvement, without additional charge or cost to the city of Chicago, in such good order and condition as will be satisfactory to the Board of Local Improvement, ordinary wear excepted, for a period of ten years from and after the completion and acceptance of the same, which keeping and maintaining shall include repairs or the entire reconstruction of the same, the necessity for which may be occasioned by or through the use of faulty or inferior material or workmanship, or from any other cause whatsoever; provided, however, the contractor or contractors shall not be required to keep or maintain any part of said improvement under this guarantee which, after its completion and acceptance, shall have been removed for the purpose of laying or repairing any gas, sewer, water or other pipe, in accordance with the permit granted

by the city of Chicago for such purpose except as hereinafter provided.

Should the said pavement be cut or removed for the purpose of laying or repairing any gas, sewer, water or other pipe by parties having first obtained a permit from the city of Chicago therefor, the contractor or contractors agree to within five days after notice so to do from the Board of Local Improvements, relay, repair and repave said pavement in strict accordance with these specifications and with such material and in such manner as will leave the whole pavement in as good and durable condition as it was before the same was cut or removed, the cost thereof to be paid for at the rate of —— per square yard by the city of Chicago out of its general fund.

If the contractor or contractors shall fail, neglect or refuse to repair, keep and maintain the said pavement in good order and condition, in accordance with these specifications, within five days after notice so to do from the Board of Local Improvements, the said Board of Local Improvements may proceed to do so or caused to have done the work necessary to comply with the same, and collect the cost and expenses thereof from the said contractor or contractors or his or their bondsmen.

Up to January 1st, 1907, there were approximately two hundred and fifty-seven miles of asphalt, twenty-two miles of brick, twenty-two miles of granite and one and one-half miles of creosoted block laid under this 10-year guarantee clause. In the past nine years, there have been many changes in the personnel of the contractors, due to deaths, failures, combinations or other causes. A very great percentage of this work, of course, has been done by contractors who are still doing business for the city of Chicago, and who have therefore maintained their work without recourse to unusual proceedings but with six different contractors, involving over thirty different streets, it has become necessary to make repairs where the contractor and surety company have both failed so to do in response to an order from the Board of Local Improvements.

In a legal opinion rendered the Board of Local Improvements, it was held that it could bring suit, under the contract, upon an estimate of the cost of the repairs, although the city had been to no expense in making any repairs. Accordingly, when a street needed attention, it was customary to serve a notice upon the contractor, giving him five days in which to make repairs, and if, upon the expiration of that time, nothing had been done, to notify the surety company; and if they likewise refused or failed to comply, an estimate of the cost of such needed repairs was furnished the Legal Department and legal proceedings instituted for the recovery of such amount. Undoubtedly, as a proper method to pursue under the contract, this was correct; but as these cases were filed in the Circuit Court, not being emergency cases, they had to take their turn on the calendar, and have not yet been called, although instituted in February, 1904.

In the meantime the condition of the pavements was getting worse and worse, department officials were being harassed by the numerous complaints, and the city was being held liable for accidents resulting from the dangerous condition of the streets. In but two instances did the surety companies respond and make repairs, and in one instance they held negotiable papers of the contractors sufficient to reimburse them for any expense incurred; in the other instance it was the only contract upon which the company was the surety and they desired to keep in good standing with the city of Chicago, the Board of Local Improvements having notified the heads of other departments of the failures of these companies to comply with the request of the Board of Local Improvements.

When called in consultation, they have held in general their refusal for making repairs as being based upon such technicalities in the specifications as that the material and workmanship had been inspected by the city of Chicago, and had been passed upon by its officials, or that the actual expenditure had not been made by the city, or that the condition of the street was due to ordinary wear, which was excepted specifically in the contract and specifications.

As an example of the operation, I have in mind one street which was paved in 1901. The pavement began to disintegrate two years after construction, so that the contractor had to make repairs in 1903. In the spring of 1904, the contractor having gone out of the paving business, the surety company made the repairs, and in the fall of the same year the street again became dilapidated, and the contractor and surety refusing to do anything further, the city was obliged to appropriate money and make the repairs. The street was again repaired in the fall of 1904 and in 1905, and in 1906 it became evident that repairing in places was of no avail, and it was then decided, after detailed notes of the street were made and photographs

taken, to advertise for the entire resurfacing of the part of the street which had always been the worst, and to repair the remaining part and take a guarantee for this work to extend to the date of the expiration of the original 10-year guarantee, viz, 1911. When the surety company was called in, it stated, in substance, that it could do nothing until the city had secured a judgment against it and its principal, because the principal had warned it to pay only at its peril, stating that he did the work under city ordinance and specifications, complying in all cases with the instructions of the Inspectors and Engineers, and that the city accepted the work and thereby relieved him from further obligation.

Arising from this case a form of guarantee was used which differed from the guarantee of 1898, given above, only by the elimination from the first paragraphs of the words "ordinary wear excepted" and those from "the necessity" to the end of the paragraph, the attorney holding that "the legal effect of the new guarantee would be to limit the number of justifiable reasons that a surety might assign for refusing to respond to his obligation; and the principal distinction between the old form of guarantee and the new would be that the wording of the old form would admit of many more possible grounds for evasion by the surety than the new one."

Not allowing that this sufficiently strengthened the position of the city, the fact remained nevertheless that any document involving any contract can be taken into the Courts of judication, and I believed it advisable to take up with the Board of Local Improvements, in 1906, the question of again returning to a cash reserve and a shorter guarantee period.

In my communication to the Board, I was of the opinion that it was desirable to return to the method of the cash reserve, based upon a set figure per square yard of pavement, or on a percentage in dollars of the total amount of the final contract quantities, with a further security by personal or other bonds. If such a change was to be made, it was advisable to limit the period of guarantee on asphalt, brick, creosoted block and granite block pavements to five years instead of ten years, and possibly on granite block to only three years.

To illustrate the application of such a reserve, take the cost of the work done during 1905 by one of the asphalt paving companies, viz. $1,400,000.00. The retained moneys, at ten per cent, would be $140,000.00; and the total amount so retained, assuming that the cost of the work for a number of years would be constant, would, on a 5-year guarantee period, be three times this amount, or $420,000.00. Correspondingly, the probable total maximum amount of all retained moneys would be $1,200,000.00. If provision could be made to pay five per cent, per annum, say $60,000.00, on the retained moneys, the reserve voucher would be readily negotiable, and hence the use of this system would, in my opinion, not increase the cost of the work. Among the objections which might be brought against this scheme are:

1. The question as to the legality of the City Council appropriating money for such purposes.

2. Likelihood that the retained moneys would considerably reduce the capital of contractors of limited means and deter such from bidding upon the work.

3. Similarly, it might be a hardship on contractors customarily doing a large amount of work, who most likely work on a smaller percentage of profit, and who would soon have a large amount of capital tied up, as illustrated in the extreme case cited.

4. That it could be stated that were this amount retained, it itself would not be sufficient to pay for reconstructing the entire wearing surface in the case of asphalt, brick or creosoted block pavements.

The points that might be mentioned as favorable to this plan are:

1. That the cost of the great number of repairs needed on the pavement is but small in comparison with the amount retained, and the Board would be duly protected in the matter of having repairs made.

2. That with the moneys in the possession of the Board, the ordinary repairs would be made, because contractors would endeavor to secure the return of the reserve.

3. With the moneys in the hands of the Board, the Board could spend the money and then defend the suits, while at present it has to spend the money and prosecute the suits.

4. That if not sufficient moneys were secured on a street to entirely pay for the reconstruction of the surface, the Board very likely would be in a position, with the accumulated

reserves of the ordinary contractor, to act most arbitrarily in the matter.

5. That under the present system we have had twenty-eight lawsuits and have had repairs made on but three streets, and none under such conditions that they could be considered as precedents made by the guarantee companies.

From this arose our present form of guarantee, by which we retain, on asphalt, brick, creosoted block and granite block, five per cent. of the total amount of the contract, including all items such as curbing, grading, paving, etc., and is as follows:

It is hereby understood and agreed that the material furnished and used and the workmanship employed in the construction of the said improvement shall be of such character and quality as to insure the same to be free from all defects, and in continuous good order and condition satisfactory to the Board of Local Improvements, for a period ending five years from and after the first day of December next following the completion and acceptance of the same; and as a guarantee of the faithful performance of these specifications, the quality of the materials furnished and the proper construction of said improvement, the contractor hereby agrees to keep and maintain said improvement, without additional charge or cost to the City of Chicago, in such order and condition as will be satisfactory to the Board of Local Improvements, for the period ending five years from and after the first day of December next following the completion and acceptance of the same, which keeping and maintaining shall include repairs or the entire reconstruction of the same; provided, however, that, if the said pavement should be cut or removed for the purpose of laying or repairing any gas, sewer, water or other pipe by parties having obtained a permit from the city of Chicago therefor the contractor agrees to, within five days after notice so to do from the Board of Local Improvements, relay, repair and repave said pavement in strict accordance with these specifications, and with such material and in such manner as will leave the whole pavement in as good and durable condition as it was before the same was cut or removed, the cost thereof to be paid for by the city of Chicago out of its general fund at the rate of three dollars for each square yard and fraction thereof; provided, however, that the compensation for the repair of any single opening shall not be less than ten dollars.

It is hereby further understood and agreed that in order to enforce the faithful performance of the terms and conditions of said above agreement on the part of the contractor, to keep, maintain and repair said improvement, the city of Chicago, through the Board of Local Improvements, may, upon the completion of said work, retain five per cent. of the cost of the total work performed by the contractor on the following terms and conditions:

If the contractor shall fail, neglect or refuse to repair, keep and maintain said improvement in good order and condition in accordance with this contract and specifications within ten days after notice so to do from the Board of Local Improvements, the city of Chicago, through the said Board of Local Improvements may, without further notice to said contractor or surety, immediately have such repairs made and pay for the cost thereof out of said five per cent. reserve fund, first, either in favor of the party employed to make such repairs, drawn against the original assessment warant; or, second, in case the five per cent. herein retained is insufficient to pay the cost of repairs, then the same may be paid for in the same manner out of any moneys retained or which may hereafter be retained in the manner as aforesaid on other contracts made or which may hereafter be made by the within contractor with the city of Chicago for street improvements constructed under special assessment proceedings.

And it is expressly agreed that any moneys paid or vouchers issued in payment for repairs in accordance with this agreement shall be considered as so much money paid to the contractor herein, and said contractor hereby releases and discharges the city of Chicago and the special assessment warrant from all claim or obligations to the extent of the money so paid for repairs, the same as though such money had been paid to the contractor.

At the end of each year from and after the first day of December next following the completion and acceptancs of said work, if the said improvement, and any and all other improvements under contract by the contractor and the city of Chicago shall pay the contractor one-fifth of the money which shall have been so retained by the city of Chicago on the contract herein as aforesaid, together with the ratable interest thereon collected by the city upon the installment of the assessment out of which such installment of reserve fund is payable, less any amount which the city of Chicago may have expended for repairs as aforesaid; and at the end of each succeeding year the city of Chicago upon the same conditions and with like deductions shall pay the said proportionate amount, to-wit, ont-fifth part (and ratable interest as aforesaid) from all the money so retained until the amount shall be paid.

No interest shall be paid upon the money so retained where the assessment for the improvement is collectable in one installment.

It is hereby expressly understood and agreed that if a contractor fails, refuses or neglects to make the repairs on the improvement herein provided for, after notice as aforesaid, the city of Chicago may not only use the moneys retained as aforesaid on said improvement, but may apply any moneys which may have been retained as aforesaid on contracts for other improvements, to make the repairs on the improvement herein provided for; provided, however, that the moneys retained as aforesaid on the improvements herein provided for shall be first exhausted before the moneys retained upon any other improvement shall be so used, but except in cases of public urgency, the city of Chicago stipulates that it will not require repairs to be made between the fifteenth day

of November and the first day of the next succeeding April.

It is further understood and agreed that the money to be retained as aforesaid shall be deemed only as security additional to the bond of the contractor executed to secure the performance by the contractor of this agreement, and that the liabilities of the contractor shall in no way be abridged or modified by the retention of said money as aforesaid.

As will be seen, the period of guarantee for all strets expires at one and the same time, and while there is not retained a sum sufficient for extensive repairs upon any individual street, I believe that the sum of reserves for any appreciable amount of work done by a contractor will be sufficient to thoroughly protect the city.

Upon the completion of the work, the contractor is issued the following certificate, which can be hypothecated at the banks:

CITY OF CHICAGO.

Retainer's Certificate.

This is to Certify, That..... Dollars has been retained by the City of Chicago out of the total amount for work done by ..... on ..... contract for the improvement of..... under special assessment warrant No.....

Now if the said..... or ..... surety shall well and truly perform the requirements set forth in the contract for said improvement as to the guaranty and maintenance of the same upon this and other improvements, the City of Chicago will, on the first day of December next following the completion and acceptance of the work, upon the surrender of the attached coupons in their consecutive order and of this certificate at the end of the fifth year, issue to .....or.....assigns special assesment improvement vouchers, payable out of said special assessment fund, but out of no other fund whatever, a voucher or vouchers for one-fifth of the amount so retained by said city. Said vouchers to draw interest at the rate of five per cent. per annum, payable annually, from..... 190.. as is evidenced by this certificate and the five attached coupons.

BOARD OF LOCAL IMPROVEMENTS.

By.....President.

.....Secretary.

No form of guarantee and reserve will be ample to protect the city against inferior workmanship, and the remedy, it appears to me, will have to come by the granting of broader powers to those to whom is intrusted the awarding of contracts, and that the word "responsible," as commonly used in the expression "the lowest, regular, responsible bidder," must be taken in the moral as well as financial sense.

BOOKS FOR ENGINEERS.

The list of books for Engineers begun in the April number of MUNICIPAL ENGINEERING is continued. Suggestions of additions, corrections and changes are invited from our readers for insertion in a supplementary list.

PERIODICALS—CONTINUED.

Marine Engineering, New York, monthly, $2.00.

Marine Review, Cleveland, weekly, $3.00.

Miner and Minerals, Scranton, monthly, $2.00.

Municipal Engineering, Indianapolis, monthly, $2.00.

Municipal Journal and Engineer, New York, monthly, $3.00.

Pattern Maker, Cleveland, monthly, $1.00.

Power, New York, monthly, $2.00.

Proceedings American Society Civil Engineers, New York, 10 Nos., $6.00.

Proceedings New York Railroad Club, New York, monthly, $1.00.

Proceedings St. Louis Railway Club, St. Louis, monthly, $1.00.

Proceedings Western Railway Club, Chicago, monthly, $2.00.

Railroad Gazette, New York, weekly, $4.20.

Railway Master Mechanic, New York, monthly, $1.00.

Railway Age, Chicago, weekly, $4.00.

Railway and Locomotive Engineering, New York, monthly, $2.00.

Scientific American, New York, weekly, $3.00.

Scientific American Supplement, New York, monthly, $5.00.

Sibley Journal of Mechanical Engineering, Ithaca, monthly, $2.00.

Stevents' Institute Indicator, Hoboken, quarterly, $1.50.

Street Railway Journal, New York, weekly, $3.00.

Trans. American Inst. Electrical Engineers, New York, monthly, $5.00.

Trans. American Society of Mechanical Engineers, New York, annually, $10.00.

Wisconsin Engineer, Madison, quarterly, $1.00.

Journal N. E. W. W. Association.

Western Society of Engineers.

Technical World, $1.00.

Machinery (Engr. Ed.), $2.00.

Electrical Age, $2.50.

Gas Engine.

Gas Power, St. Joseph, Mich.

EDITORIAL COMMENT

The American Society of Municipal Improvements.

The Natural Hydraulic Cement Market.

Pavement Guaranties.

THE AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.

The convention of the American Society of Municipal Improvements, recently held at Detroit, had the smallest attendance of any convention since that at Niagara Falls, when the last change in the secretaryship was made. This was not the fault of the local committee nor of the attractions of the place of meeting nor of the city government of Detroit, for the local committtee was more active than usual, the city has more than the usual number of attractions of all sorts and the city sent out a very attractive little invitation to the officials of other cities to attend.

The action of the executive committee, which was ratified by the society, seems to admit that the fault lay with the methods of attending to the society's business into which it has gradually fallen. Increasing duties of permanent officials have gradually caused the transfer of important parts of the duties of these officers to the presidents and the chairmen of committees. So long as presidents were selected who could find time to attend to these duties and keep the committees up to their work they were taken care of with whatever skill the incumbents of the office happened to possess, and there has been no difficulty in carrying on the business of the society and in working up reasonably successful conventions. But when one too busy to look after the duties is put in charge the effect is immediately noticeable.

Before changing secretaries, the executive committee and the society decided to appropriate to the secretary practically all of the available balance in the treasury for aid in prosecuting an advertising campaign. This looks a little as though the committee had taken the situation a little too seriously and had rushed to the other extreme in adopting what looks like a "kill or cure" remedy. The society is too valuable and its value is too fully recognized for any fear of the outcome under reasonably active and judicious management. The secretary is the only paid officer of the society. He is by consent continued in his office during good behavior. He should have charge continuously of such matters as the campaign for new members and the advertising of the convention and he should have whatever money is necessary and available for the clerical help required. He should then be able to sustain the membership and the attendance without loss of effort and at a reasonable cost. The action of the executive committee is therefore the most proper motion that could have been taken and it is confidently expected that, at least until he has fallen into the rut into which secretaries too often drop, he will not only keep up but increase the membership and the attendance. His appropriation is more than ample for the first and he probably is too good a financier to spend more of it than is really useful and prospectively productive of results.

The committee work in general was not up to the usual standard. The work of the paving committee and of volunteers in that field was a notable exception. Nearly all the interest of the convention was in these papers and reports, which occupied a large part of the time. Some very valuable contributions on several paving materials and on new and modified methods of handling them were presented. Some of these are reserved for future publication, one number of MUNICIPAL ENGINEERING not being large enough to contain them all. Most of the other papers are given in full or in abstract herewith, one or two of the valuable contributions on the other subjects within the field of the society being reserved for later use.

The society is entering upon a third wave in its progress and will doubtless show promptly the effects of the new move. The change in officials was really only a shifting of positions so that there is no really new blood in the executive committee and all the push which is expected must come from a change in the attitude of the official family. Perhaps the fright, which may be inferred from the rather

radical treatment of the treasury balance, has been sufficient to induce in all a change of heart. Doubtless it will prove sufficient to have induced it in the secretary's office by means of the appropriation for office help.

THE NATURAL HYDRAULIC CEMENT MARKET.

The annual reports of the cement trade made by the U. S. Geological Survey have shown a steady decrease in the use of natural hydraulic cement, which was particularly pronounced in the last two or three years. This has led to the closing of many natural cement mills and the occasional operation of others. The mills about Louisville have long had a common selling agency, the Western Cement Company, which has done much to stem the tide and retain business for its clients, but the situation has become such that we are advised by Mr. T. A. Courtenay, the secretary and treasurer of the company that it is dissolved and will exist hereafter for purposes of liquidation. He says that arangements for next season will depend upon future circumstances.

It is to be hoped that some organization will assume the control so long and ably held by this company, for the mills are most of them too small and the expense of marketing the cement of the individual mills is too great for them to meet the strong competition of Portland cement with full success. It would be unfortunate to have natural hydraulic cement drop out of the market entirely. There are too many places where it can be used successfully and economically, it is too useful, to be dropped out of the line.

MUNICIPAL ENGINEERING has often said that cement, Portland as well as natural, is rapidly becoming a local question, freight rates limiting the distances to which a cement can be carried for successful competition unless it has qualities far above the average or which peculiarly fit it for special work. So long as the demand for cement is a little ahead of the supply this statement does not apply with its full force, but in times when building operations are somewhat restricted its application will be clearly seen.

Because of its lower price and the fewer uses to which it can be put, the development of the Portland cement industry forces the application of the same principle to the natural cement industry. The consequence is that the range of shipment of the natural cements is restricted and as the new uses of cement which have been developed are largely for Portland cement, the market for natural cement is cut off by so much.

A correspondent asks in the Question Department whether it would be advisable to reopen a natural cement plant at a certain location. He can learn from the experience of the Louisville cement plants the effect of the cutting off of the longer distance shipments. Whether he can develop local trade enough to keep his mill going any large part of the year is a question for study on the ground. There are many places where natural cement is the logical material for use within the freight rate range of the mill and whether this trade will support the mill can be estimated by one sufficiently familiar with the local trade. Our correspondent asks whether there is prejudice against natural cement. It is not so much prejudice as inertia. The large users of cement are the railroads, the large government and building contractors. A railroad, for example, prepares a standard specification for its heavy work, applicable to its whole line. It calls for Portland cement perhaps as the cheapest for much of the line. Its engineers are slow to change the specifications for such parts of the line as might be served more cheaply by natural cement. The necessity of training crews to the difference in quantities and manipulation is another force of inertia which is hard to overcome. On government work this inertia is still stronger. The field of natural cement is still further restricted, therefore, by losing much of the large work in its natural territory, so that it is restricted to the smaller work in its near neighborhood.

The rate of increase in production of Portland cement has thus far kept pace reasonably well with the increase in demand, not so close but that the price has been kept high enough to give good returns on investments. Natural cement acts in its centers of production as a slight check on this price, and comes into use in those regions when the price of Portland gets too high. It drops out again when the supply of Portland is greater than the demand and the price falls. Fortunately the investment in natural cement plants is comparatively light and the plants are reasonably permanent and can be started and stopped with comparatively little loss, so that natural cement mills kept in condition can pick up considerable business by

starting up on indications of possible business.

These are suggestions of reasons for the present condition of the natural cement trade and for the hope that many mills will be kept in condition to start even if they must be kept closed for considerable periods. Possibly our readers in this field will be willing to contribute to the discussion.

PAVEMENT GUARANTIES.

The principal subject of discussion at the recent convention of the American Society of Municipal Improvements in Detroit, was the insufficiency of the pavement guaranties which are so common and have been in use so long. The papers on asphalt and asphalt pavements, most of them prepared independently of each other, described the forms of guaranty which have been and are in use and the reasons for any changes that have been made. Most of the papers show the necessity of expert supervision of the materials in use and of the methods of construction, and one or two of the papers recommend the elimination of the guaranties and complete dependence upon the supervision, provided it is competent, honest and and continuous.

The pavement guaranty in its popular forms is really the product of the infant asphalt industry, and was a method of bringing into use a material about which very little was known by anybody, and that little was in the hands of the early experimenters with asphalt pavements, who soon secured control of the known deposits of the material and were thus able to control its use. In the third of a century since this introduction of asphalt took place much has been learned concerning the many natural and artificial varieties now known, and the practical breaking of the monopoly has thrown the market open to any one desiring to exploit it. There is no longer the incentive to carry out a guaranty that existed during the early stages, and at the same time the prices have been reduced through competition until it is no longer possible to protect a guaranty by a charge for the first construction high enough to be safe even if the wearing surface of the pavement must be reconstructed.

Many incompetent, inexperienced and comparatively irresponsible contractors have come into the field who may use any old or new, natural or artificial product which they may find on the market, having an eye to its cheapness rather than its value. The consequence is that many poor pavements are laid, although just as good asphalt pavements can be and are laid by conscientious and experienced contractors as have ever been put down. Many city engineers and city chemists are now prepared to make the necessary tests of asphalt paving materials and are fairly expert. There are some independent scientific experts who have detailed knowledge of all classes of asphaltic paving materials and their value in pavements as compared with the few empirical experts of the early days. These men are quite expert in recognizing the asphalts derived from various sources and in detecting adulterations. They are also versed in preparing specifications to suit the usual conditions as to climate, travel, local materials, etc.

The conditions have therefore changed entirely since the guaranty clause was invented, and it has now become inefficient at the same time that expert knowledge has increased and inspection, supervision and specifications have become more efficient. It is not surprising, therefore, that there should be practical unanimity regarding the desirability of the proposed change and a general movement toward making it at an early day.

The guaranty clause was transferred from asphalt to other materials partly because the asphalt promoters had set the fashion, and partly, in some cases, because there was similar lack of knowledge regarding a new but promising material. The papers on wood block and brick pavements, presented at the convention, were evidently written without knowledge of the preparation of the papers on asphalt, but they carry the same implication, that proper testing of the materials and supervision of the construction are more efficient in securing good pavements than is the guaranty clause. They admit that we do not know all about wood and brick, just as the other papers admit that we do not know all about asphalt, but our knowledge is sufficiently extended and definite to make inspection and supervision eligible to the place of the guaranty clause in insuring the quality of pavements made of them.

There will be no dearth of laboratories and experts to make specifications, examinations and inspections if the guaranty clauses are eliminated, although, probably, few except the largest cities will give employment to experts exclusively their own, the small-

er cities finding it necessary to depend upon the services and the laboratories of the experts and the cities of intermediate size perhaps having their own laboratories, inspectors and chemists working under the orders of experts from without.

Better pavements ought to result from this method of controlling their construction. This may be considered the first full formulation of the method, although it has been developing for some years and has existed to some extent for many years in aid of the guaranty clause.

THE QUESTION DEPARTMENT

SEPTIC TANK CONSTRUCTION.

I wish to obtain information regarding septic tank construction. We are considering the construction of a septic tank. At present our population is about 8,000, but we have designed the main sewer for a population of 20,000. I wish to know how large the tank should be, and plan of construction, so that I can furnish an approximate estimate of the cost. Do you know what cities are using septic tanks, and if there are any books published on sewers which describe septic tanks?

C. M. T., ———— Mont.

The paper by City Engineer C. H. Rust, of Toronto, Ont., before the American Society of Municipal Improvements, describing the sewage disposal work at Kew Beach, which is published elsewhere in this number of MUNICIPALE NGINEERING, gives some valuable data. The circumstances are somewhat similar, and, so far as the septic tanks are concerned the data may perhaps be applied directly to our correspondent's case.

In general it may be said that the average dimensions for septic tanks are in about the proportions of 20 by 80 feet and the depths are somewhere from 5 to 7 feet. There are no definite rules yet for the best dimensions. The length of time the sewage is to remain in the tanks is the principal thing and even this varies according to the quality of the sewage and the amount of purification required. Ordinarily sewage should remain in the tank not less than 6 hours and in some cases it remains, say 24 hours with good results. Too long retention in the tanks may be more objectionable then be chosen with some respect to the site of the plant and the amount of excavation. It will probably be economy to provide at the beginning two or three tanks which are sufficient for the sewage of 8,000 population, and other tanks can be added as the sewer system is extended and they are found to be needed.

There are a large number of cities now using septic tanks. A list of some of them was given in MUNICIPAL ENGINEERING, Vol. xxxii, page 95, where will be found also a list of the descriptions of septic tanks which have been given in this magazine. In this department in the October number Vol. xxxiii, p. 249, will be found still more information. There is no American book treating fully of septic tanks. There is an English book, Wood's "Sanitary Engineering," which gives some information, but the best and most complete information about American practice will be found in the back numbers of MUNICIPAL ENGINEERING referred to.

ASPHALT SURFACER.

A customer of ours is wanting a machine for leveling down inequalities in asphalt pavement. He says there is such a machine used in the east, but he does not know who builds it, therefore writes us for information and prices. Do you know of such a machine being manufactured, and if so, can you tell us who the manufacturers are?

I. M. R., Fort Wayne, Ind.

Reference is probably made to the Blake asphalt patcher. This formerly was controlled and is possibly now controlled by F. O. Blake, whose last address known to the writer was Pittsburg, Pa. It heats up the pavement and permits it to be rolled back smooth again, whatever asphalt is necessary to bring it up level being added. Besides this machine there are the Perkins heater, which heats the sur-

face of the pavement for the purpose of removing the asphalt and leaving space for new asphalt to be put in and one put on the market by the Iroquois Iron Works, of Buffalo, N. Y.

GUARANTEE CLAUSES IN PAVING SPECIFICATIONS.

I have read in October number of MUNICIPAL ENGINEERING, article entitled "Paving Repairs in Chicago."

As you say original contracts for paving usually contain a clause for warranting the pavement for a number of years. Original contracts also generally incorporate a set of specifications prepared by the city engineer and the contractor is required to carry out these specifications to the letter.

Do you think it is right that one man should be required to guarantee another man's specifications? Have the courts generally decided against the contractor or his bondsmen in such cases?

I have heard of a case, which I do not know the truth of, in which the contractor won out.

In the State of Georgia, he had guaranteed some sidewalk for a period of five years, but was required under the contract to do the work in accordance with the city engineer's specifications. He was sued upon refusing to make repairs, and won the case.

Do you know of any such cases?

The reason I write this is that I have been criticised because I would not include such a clause in specifications I have prepared.

C. L. P., Sheffield, Ala.

The subject of this letter was quite thoroughly discussed at the recent convention of the American Society of Municipal Improvements and the general opinion was in favor of our correspondent's position. The most modern proposition is to eliminate the guarantee clause entirely from the specifications and to put the supervision of the construction of the pavement in the hands of expert engineers who will be held responsible for the condition of the pavement rather than to attempt to hold the contractor by a guaranty. The report from Chicago concludes that the lack of sufficiency of the guaranty is quite discouraging, no guaranties having been enforced in that city except those held by contractors who were doing business all the time with the city and who prefer to do the work demanded of them rather than lose their opportunity to do further work. Some contractors who have ceased to do work with the city have refused to carry out the terms of their guaranties and the city has thus far been unable to collect them although suits have been brought, except in a case or two where the contractors' bondsmen preferred for one reason or another to relieve themeslves of the burden. No suit has yet been tried. Ordinarily it is easy for the contractor to get out of his guaranty on some technicality and very few of them are held up to what is supposed to be their contract. Articles in this and the December numbers of MUNICIPAL ENGINEERING contain a discussion of this subject and will be of special interest on this acocunt.

STEAM CURING OF CONCRETE BLOCKS.

We are anxious to get some information on steam curing of cement blocks. You can no doubt give us the information wanted or can refer us to someone having tried it. Our intention is to put in a modern plant and naturally we are investigating the different methods of making and curing blocks.

R. C. H., Lincoln, Neb.

Reference may be made to an article in MUNICIPAL ENGINEERING, vol. xxxii, page 89, and also to one in vol. xxxi, page 280 and one in vol. xxx, page 200, for information on this subject. Two firms using steam curing known to the writer are the National Concrete Block Co., Milwaukee, Wis., and A. A. Pauley, Youngstown, O. Can our readers refer our correspondent to others?

CEMENT BRICK MACHINE—REINFORCED CONCRETE FLOOR.

I would like to buy a good cement brick machine. Which would you recommend?

Please give size and amount of reinforcing and cost of iron for a floor 16 by 16 feet and a ceiling 16 by 16 feet. How thick should the concrete be?

C. F. H., Point Pleasant, W. Va.

There are so many brick machines which differ but slightly and there is so much difference of opinion about them that the writer does not feel justified in selecting any one for indiscriminate recommendation. The machine must be chosen largely in accordance with the user's preferences and some experience with various machines is necessary before one can even do this. Our correspondent is referred to the makers of cement brick machines listed in the "Business Directory" published in each number of MUNICIPAL ENGINEERING under the heading "Cement Brick Machinery," and part of those under "Concrete Construction Machinery."

The hand book of the Expanded Metal and Corrugated Bar Co. of St. Louis, Mo., gives tables of loads on concrete floor slabs of various spans, reinforced with the Johnson bar. Allowing a factor of safety of 4.5, a slab

of 16 feet span 5 inches thick, reinforced with ½-inch bars properly placed and spaced 4½ inches apart would carry 100 pounds a square foot in addition to the weight of the floor. This would require about 525 pounds of the bars. The cost of the reinforcement can thus be determined when the local price for bars is known.

WESTERN CEMENT PLANTS.

Will you please send me a list of all of the cement mills west of the Mississippi that are now under construction and have been completed since the issue of your cement directory.

N. M. Co., Lincoln, Neb.

The following cement plants are now in operation or will shortly be in the territory west of the Mississippi river:

Dewey Portland Cement Co., Dewey, Okla.

Independence Portland Cement Works (Branch of Kansas Portland Cement Co.) Independence, Kans.

Vancouver Portland Cement Co. Office, Victoria, B. C.

These are companies not included in the last edition of the Directory. Of the plants reported in the fourth edition of the Directory as under construction the following have been completed in the territory referred to, or will shortly be completed.

Commercial Cement Co, Babcock, near Carman, Man.—Natural cement.

Indian Portland Cement Co., Neodesha, Kans.

Kansas City Portland Cement Co., Heist Bldg., Kansas City, Mo.

Lehigh Portland Cement Co., Mason City, Ia.

Northwestern States Portland Cement Co., Mason City, Ia.

OUTLOOK FOR NATURAL CEMENT.

As a new subscriber of "MUNICIPAL ENGINEERING" I wish to ask you a few questions in regard to cement manufacture.

With some others I am interested in a cement property in an adjoining State upon which is a plant, operated within three years, manufacturing natural cement. This plant has been idle since the death of the owner and it could now be bought at a reasonable figure. The machinery is in fairly good condition but would need some overhauling. There is an unlimited amount of cement rock on the place. A railroad siding runs into the grounds, while the canal flows in front of the property, bringing cheap fuel, and furnishing cheap facilities for marketing the cement.

What I would like to know is whether there is demand enough for natural cement to warrant us putting the plant in operation. What are the principal uses for natural cement and is it used generally in large concrete operations? Is it used by the Government, and by railroads? Is not there a prejudice against its use?

C. W. H., Camp Hill, Pa.

This is quite an important question at the present time and deserves careful attention.

The sale of natural cement is now very largely a local question, as the freight rate will soon become too great for competition of the cement with Portland cement or natural cement from other localities. The excellent shipping facilities described may give a larger radius than is sometimes available. Natural cement is excellent for foundation purposes and for use in structures which are not subjected to the action of the elements. A larger amount is necessary in concrete to produce the same results than with Portland cement, but the lower price keeps it within range of competition in cost. Natural cement concrete is not satisfactory for outside surfaces, where appearance or even great durability are essential, but it can be used successfully for the foundation and interiors of piers, abutments, etc., and where it can be furnished cheap enough to compete with Portland cement a trade may be developed. Portland cement has become so cheap that it has replaced natural cement in many places where it formerly could not find entrance and because of the larger use of Portland cement for everything, even where they might save some money by using natural cement in some places. This can hardly be called prejudice but is rather a tendency to adhere to regular methods of construction, which are not changed by the comparatively small saving which might be made by modifying the methods in exceptional instances.

The fact in the case is that the use of natural cement is now hardly half what it was two or three years ago and as stated above it has become simply a local question and whether there is local demand enough, that is demand within the range of local freight rates and the local transportation facilities, to give a market for the product of a factory must be estimated after a careful study of these local conditions.

The report of the dissolution of the selling agency of the Louisville and Indiana natural cement mills, published elsewhere in this number, is another sign of the times.

WEIGHT OF CONCRETE.

Would you be kind enough to advise us the approximatae weight of one

yard of concrete. We wish this for our dump wagon department files, and would appreciate it very much if you can give us the information.

STUDEBAKER BROS. MFG. CO.,
South Bend, Ind.

A cubic foot of trap rock concrete weighs from 148 to 160 pounds, the heavier weight being for the larger size of aggregate. Pebble concrete weighs from 148 to 151 pounds and cinder concrete from 103 to 113 pounds per cubic foot.

MATERIALS AND METHODS OF LAYING POLISHED CEMENT FLOORS.

I wish you would give me the names of firms who handle crushed granite or other material which is used for polished cement floors. Where can I get full information as to laying and finishing such floors?

A. R. S., Sabetha, Kan.

The "Handbook for Cement Users" ($3) contains instruction on this line. Some instruction will also be found in Potter's "Concrete" ($3), an English book.

Dealers in the kinds of crushed stone desired, who are nearest our correspendent are the Twentieth Century Granite Co., Little Rock, Ark., and Omaha, Neb.; Amberg Granite Co., Chicago, Ill.; Western Granite Supply Co., Chicago, Ill.; Western Granite Co., Chicago, Ill.; P. M. Bruner Granitoid Co., St. Louis, Mo.; Geo. Pickel Granite Crushing Co., St. Louis, Mo.; Denver Marble and Granite Co., Denver, Col.

LIST OF CEMENT USERS.

At what price will you furnish us with a complete list of large users of cement in the United States and Canada?

G. D. R., Appleton, Wis.

The "Directory of American Cement Industries" ($5) contains the only lists of this sort that are published. The credit ratings and statements of amount of cement used show the standing of the various contractors and other users in the field.

HYDRATED LIME IN CONCRETE.

Can you give me any information or source of information in regard to hydrated lime and its action when introduced into cement mixtures, with reference to strength, color, and permeability? As I desire to obtain authoritative intelligence, I shall accept as authentic any knowledge submitted by you on this subject.

J. B. G., Chicago, Ill.

Sabin's "Cement and Concrete," ($5) gives the results of numerous experiments made with various proportions of lime in cement mortars and concretes. His conclusions are that cement mortars containing as much as three parts of sand are rendered more plastic and their tensile strength is increased especially if the mortar is kept damp during hardening, by the addition of ten to twenty per cent. of slaked lime. For mortars exposed to the open air the lime should be in the form of hydrated powder. The effect is still more pronounced with natural cement than with Portland cement. The adhesive strength of Portland cement mortar for brick is slightly increased by the addition of a small amount of hydrated lime. Larger quantities of lime than those named above decrease the strength of the mixture.

Mr. Sabin is doubtful about the efficacy of hydrated lime in cement mortar in reducing permeability, but Mr. S. B. Newberry is quite strong in the expressions of his opinion that lime is an aid in the reduction of permeability of cement mortars. He has written several articles on the manufacture of cement blocks in which he takes this stand as the result of his experiments, as well as reporting material increase in strength. MUNICIPAL ENGINEERING, vol. xxx, contains three of these articles on pp. 255, 359 and 418. Other articles on the greater strength of lime and cement mixtures will be found in vol. xxiv, p. 217 and vol. xxvi, p. 129.

The color is lightened somewhat, but the proportion used is not great enough to have a very pronounced effect.

Reference may also be made to the "Hand Book for Cement Users" ($3) for information.

DESIGN OF CONCRETE ARCH.

I am figuring on a concrete arch bridge of about 100 ft. span and would like to ask a few question in regard to the same. The street where this bridge is located is on an ascending grade of about 2 per cent. to the bridge, and at the other end the grade is an ascending one of about 6 per cent. Would it be advisable to design a bridge to be on a grade of 1 per cent. This bridge is to be of reinforced steel concrete construction, and the present bridge is between 15 and 20 feet above the water at low water. What would be, in your opinion, the least permissible amount of rise in 100 ft. span? Could the thickness of the arch ring be less than that for a stone arch.

Have any of the back numbers of the MUNICIPAL ENGINEERING managine designs and descriptions of such arches as the one I have mentioned?

G. B., Hastings, Mich.

There is no objection to putting a grade on the roadway of such an arch as that described. It would, of course,

load one end of the arch slightly more than the other, unless the load is reduced by voids in the higher end of the bridge. The usual rule for the rise of an arch is from ⅛ to 1-10 of the span, but with re-inforced concrete construction it is possible to use almost any rise which is necessary and of good appearance, even to the extent of making a reinforced concrete girder. The amount and character of reinforcing will depend upon the system used and the design and if one of the regular systems of reinforcing concrete arches is to be used the engineers for that system will work out the design for the local condition if desired. In reinforced concrete arches the arch ring can be less than for stone arches. Following are references to articles in back numbers of MUNICIPAL ENGINEERING on this subject:

"Highway Bridges of Concrete," vol. xix, p. 388.

"Melan Arch Bridges in Indianapolis," vol. xx, p. 63.

"Westvale Concrete Bridge," vol. xxii, p. 137.

"Comparison of Stone and Concrete Arch Bridges," vol. xxii, p. 159.

"Unequal Loading of Arches," vol. xxii, p. 160.

"Concrete-Steel Bridges," vol. xxiii, p. 155.

"Concrete Arches," giving dimensions of many, vol. xxiii, p. 199.

"A Small Concrete Arch," vol. xxiii, p. 477.

"Concrete Steel Arch Bridges," vol. xxiv, p. 127.

"Dimensions of Concrete Arch," vol. xxiv, p. 436.

"The Concrete Bridge of the Illinois Central Railroad Over the Big Muddy River," vol. xxvi, p. 152.

"Concrete Steel Bridges at Dayton, O.," vol. xxvii, p. 83.

"The Thebes Bridge over the Mississippi River," vol. xxvii, p. 90.

"Concrete Arches for Railroads," vol. xxvii, p. 168.

"A Concrete Bridge Failure," vol. xxviii, p. 207.

"Reinforced Concrete Arches," vol. xxviii, p. 442.

"Reinforced Concrete Bridge on East Washington Street, Indianapolis, Ind.," vol. xxxi, p. 1.

"Renewing Railroad Waterways with Concrete Culverts," vol. xxxi, p. 9.

"A Low Cost Concrete Culvert," vol. xxxi, p. 315.

NEW CEMENT PROJECTS.

1. I write to ask if you can give me a list of the new cement projects that have been either put into operation or under way since the publication of the last "Directory of American Cement Industries." Merely name, location, capitalization, capacity and character of product. Do not care for the names of officers.

2. Further, can you give me some information as what cement the Government is now using on the Panama canal, where obtained and the price paid. If foreign cement can you give the freight rate from point of export to Panama?

L. B. K., Chicago, Ill.

1. In the July number of MUNICIPAL ENGINEERING, vol. xxxiii, p. 26, will be found a list of names and addresses of cement companies which have taken some steps toward development since the last edition of the "Directory of American Cement Industries" ($5) was published. This includes companies which have not progressed beyond the stage of incorporation as well as those which are constructing or have constructed plants. The capitalization of but few of the companies is given because usually it is not yet sufficiently definite to warrant a figure being assigned. Following are additional names and addresses collected since the publication of the list in July, the list including some changes in the earlier one on account of receipt of additional and more detailed information:

Ajax Portland Cement Co., Dwight Bldg., Kansas City, Mo., works under construction near Independence, Kan., capital authorized $2,000,000 preferred and $2,000,000 common stock.

Alamo Cement Co., San Antonio, Tex., new plant proposed at Adams, Tex.

Allentown Portland Cement Co., Allentown, Pa., proposes works at Egypt, Pa., reported capitalization, $2,000,000.

Alsen's American Portland Cement Works, near Catskill, N. Y., new incorporation of plant at Alsen's, N. Y., capital $2,400,000.

Altoona Portland Cement Co., 1613 Dwight Bldg., Kansas City, Mo., plant proposed at Altoona, Kan.

Ben Allen Portland Cement Co., proposes plant at Ben Allen, near Owen Sound, Ont. with capital of $500,000.

Berkshire White Portland Cement Co., Augusta, Me., plant proposed in Connecticut, capital $250,000.

Bronson Portland Cement Co., reported incorporated at Portland, Me., with $200,000 authorized capital.

Continental Portland Cement Co., St. Louis, Mo., capitalization authorized $3,500,000, plant proposed 3 miles south of St. Louis.

German Portland Cement Co., Chan-

ute, Kan., proposes works near Chanute.

Grand Canyon Lime and Cement Co., Los Angeles, Cal., is reported as proposing addition of cement manufacture to its lime business at Grand Canyon.

Great Western Cement Co. is reported to have property near Moran and Bayard, Kan., and to propose the construction of a Portland cement plant.

Guthrie Mountain Portland Cement Co., has general offices in N. Y. Life Bldg., Kansas City, Mo., and proposes plant at Mapleton, Kan., capitalization authorized $2,000,000.

Idaho Portland Cement Co., Sugar City, Idaho, proposes a plant at Pocatello, Idaho.

Inter-Mountain Cement and Brick Co., Salt Lake City, Utah, is reported to have cement lands at Idaho Falls, Idaho, and a patented process for making Portland cement.

Inter-State Portland Cement Co., incorporated in Colorado with authorized capitalization of $4,500,000, to build works near Crane and Independence, Kan.

Iowa Portland Cement Co., is reported to have changed its location from Mason City to Des Moines, Iowa.

Kaw Portland Cement Co., authorized capital $3,000,000, and proposed works near Ft. Scott, Kan., is reported to have opened offices in Kansas City, Mo.

Los Angeles Portland Cement plant is under construction by the Department of Public Works of Los Angeles, Cal.

Missouri Portland Cement Co., Oklahoma City, Okla., is reported to propose a plant near Weston, Mo., and Atchison, Kan.

Monarch Portland Cement Co., variously reported from New York City, Guthrie, Okla., Wichita and Chanute, Kan., with authorized capitalization of two to four million dollars proposes a plant at Humboldt, Kan.

Montana Cement Co., reported as building plant near Logan, Mont.

Muskegon Portland Cement Co., Muskegon, Mich., authorized capitalization $1,000,000, plant proposed near Holton, Mich.

National Cement Co., Newark, N. J., authorized capitalization $2,000,000, proposes plant near Carpentersville, N. J.

National Portland Cement Co., 413 Mutual Savings Bank Bldg., San Francisco, Cal., reported incorporated with authorized capital of $5,000,000 to build plant near Salinas, Cal.

New Era Cement and Stone Co., San Francisco, Cal., reported incorporated with $1,000,000 capital to make cement, etc.

Occidental Portland Cement Co., Jersey City, N. J., reported incorporated at Trenton, N. J., with authorized capitalization of $2,000,000.

Ohio Cement Co., reported incorporated by Detroit parties at Chester, W. Va., to operate in W. Va., with authorized capital of $4,500,000.

Panama Portland Cement and Development Co., Batavia, N. Y., incorporated at Dover, Del., with authorized capital of $1,000,000, to build Portland cement plant on Tombigbee river in Alabama.

P. & M. Cement Co., incorporated to build plant at South River, N. J., by E. M. Carroll, New York Tribune, New York City and others.

Pittsburg Cement Corporation, Fulton Bldg., Pittsburg, Pa., proposes plant near Dunbar, Pa.

Rusk Iron Co., New Birmingham, Tex., proposes plant at Rusk, Tex., W. H. Oatley, gen. mgr.

St. Stephens Cement Land Co., St. Stephens, Ala., capital $50,000, proposes cement plant.

San Juan Portland Cement Co., near Chittenden, and San Juan, Cal., proposed plant.

Saylor Portland Cement Co., incorporated in Pennsylvania by Philadelphia capitalists to manufacture Portland and other cements and their products.

Spokane Portland Cement Co., Spokane, Wash., incorporated.

Standard Portland Cement Co., proposes plant at Castalia, O.

Superior Portland Cement Co., Seattle, Wash., plant under construction at Baker, Wash.

Van Dorn Portland Cement and Coal Co., reported organized at Shreveport, La., with authorized capital of $1,250,000.

Wahsatch Portland Cement Co., reported incorporated at Jersey City, N. J.

Both foreign and domestic cements are used at Panama. The foreign cements compete on account of freight rates being low at times, the cement being carried as ballast. For this reason the freight rates are irregular and hard to quote.

REINFORCED CONCRETE POSTS.

I note with considerable interest your October number which contains a list of questions and answers in regard to the manufacture and use of concrete posts. As you invite discus-

sion on the subject, I take the liberty to make the following suggestions:

2. In regard to the adhesive power of concrete on steel, if I am not mistaken, the tests which show the high adhesive power that you refer to are laboratory tests which are made under ideal conditions and these conditions include concrete perfectly mixed with a minimum amount of water and sufficient ramming to insure perfect bond. In your No. 19 you recommend a very wet mixture which is of course necessary to get material well compacted with little labor in ramming. In my opinion, this method is open to the objection that in reinforced work, a very wet concrete is apt to shrink away from the reinforcement, this shrinkage being to a considerable extent in proportion to the amount of water employed, i. e., the evaporation of that portion of the water which does not enter into chemical composition with the cement will cause contraction of the concrete.

10. Owing to the contraction of concrete as above stated, it is considered by many a wise precaution to hook or in some manner anchor the ends of all reinforcing rods and wires as an additional safeguard and in the writer's opinion, it would seem that the little trouble and expense of such anchoring would be fully justified by the extra safety insured.

11. It is such a common error among cement users that simply to use more cement means to strengthen the mixture in the most economical manner that it might be well to elaborate somewhat in your reply and advise to use sufficient cement for the mortar and "enough mortar to fill all the voids in the broken rock and to coat each individual piece of the rock used" which usually means ten or twelve per cent. more than enough mortar to fill the voids.

A. M. SHAW, Zacatecas, Mex.

This subject was taken up in the discussion of a talk by Prof. C. W. Marks at a recent meeting of the Indianapolis Technical Club. With reference to (2) above, the general opinion was to the effect that there is no danger of the concrete shrinking away from the reinforcement in setting. On the contrary, the opinion was expressed by several that the shrinkage of the concrete in setting in the air would grip the rods the tighter. However, the concrete used in making posts in a mold would hardly be called wet. This is a case where "as wet as possible" is still far from "wet," for the concrete must be tamped into the mold and then be dry enough so that the mold can be promptly removed.

With reference to (10) the advisability of the hooks or turns at the ends of the reinforcing bars was admitted by all.

MUNICIPAL ENGINEERING has always preached the filling of the voids to secure the strongest concrete and will continue to repeat this formula at frequent intervals. Exact proportions can not be stated. Those given such as 1:3:6 or 1:2:5 are only approximate and, for full strength of concrete should be modified to suit the materials actually used.

POLISHING TOOL FOR CONCRETE FLOORS.

Can you give me the address of a manufacturer of a polishing tool for concrete or terrazzo floors?

G. N. S., Elgin, Neb.

Probably the Contractors' Tool Co., Philadelphia, Pa., or W. H. Anderson and Sons, Detroit, Mich., can supply the desired tool. Can our readers give us the names of other manufacturers?

HOW TO PUT NEW FINISHING COAT ON OLD CONCRETE.

Kindly advise me what you consider the best preparation for or method of treating the surface of old concrete in order to provide the best bond for an extra or new coat of finish. Say, a floor for instance? Is there not a recently patented preparation or process in which coal tar pitch is used.

H. N. B., Lewiston, Ida.

The cement workers who have the best success with plastering cement on old surfaces, which is practically what you are asking for instructions on, follow about the following method:

The old surface is roughened carefully so as not to leave any material which has been loosened from the old mass, but not entirely broken off. This surface is then thoroughly brushed and washed so as to remove all dust or loose particles and the mass is moistened as thoroughly as necessary to prevent the absorption of water from the new coat. This new coat is then applied, and some workmen say it is best to apply it by throwing the mortar at the surface so as to give it a considerable momentum in striking the old surface. The mass thus applied is then smoothed down and the surface finish put on in the usual way. Some men are very successful in this kind of work, whether the old surface is cement, brick, stone or even wood.

There is a process for annealing cement, in which a wash is applied to the old concrete surface, prepared in some such way as described above. The claim is that this substance anneals the surface of the old cement, whatever that term may mean, and causes the new cement to stick to it. The writer cannot report regarding the value of this method from his own experience.

In a lecture before the Indianapolis Technical Club, Prof. C. W. Marks described, incidentally, a method of treating old cement surfaces, first prepared as above described, with dilute commercial muriatic acid, say one part to six parts of water, the acid being then thoroughly washed off and the new finish then applied in the usual manner for new work. He reports this method as successful.

The use of asphalt or tar, as suggested in the question, makes a separation, which, while good for some purposes, especially making a roof, wall or floor waterproof, does not make a homogeneous mass and the finishing coat must be designed and constructed with this understanding. It is quite a different matter from a finishing coat on a concrete surface, as ordinarily used.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know, use this Department for what you can tell others.

MEASUREMENT OF ELECTRIC LIGHT.

I respond to your request to give you some notes concerning the matter of electric street lighting following the question of Col. Park of Pine Bluff, Ark. "How could it be determined that a contractor is furnishing electric light up to the requirements, for instance, 1,200 candle power?" There is no way to determine the candle power of a street lamp that will give accurate results, the first reason being that in letting contracts the term candle power has a commercial significance only, as in the early days in electric lighting the arc lamps were rated 2000 candle power by Brush, and others, and the term candle power has been used for years to designate a lamp of the brilliancy furnished by a current of 10 amperes having a drop voltage around the terminals of the lamp, varying from 40 to 52 volts. These values are largely arbitrary but nevertheless have been woven into our commercial language. What municipalities should do, in designating the quality of light required to be furnished by contractors for street lighting, is to express the electric energy to be furnished in watts, as for example, a current of 4 amperes at 75 volts at each lamp, equals 300 watts. This will represent one of the new type of low candle-power street lamps used in this city.

A current of 6½ amperes at the same voltage as above is still another unit of illumination, and, the old 10 ampere lamps at 50 volts forming at one time nine-tenths of the units of energy supplied to street electric lamps. A method of measuring the electric energy is to use a volt meter around the terminals of a lamp while burning and an ammeter inserted in the circuit will give the current value expressed in amperes. The current multiplied by the voltage equals the electric energy in watts. The above I believe covers the essential features of the discussion of the paper submitted by the committee on electric street lighting.

In relation to the new method of illumination by the use of new filaments in incandescent electric lamps, a great economy has been obtained in that a candle-power can be produced by the use of one watt and the life of the lamp is in the neighborhood of one thousand hours. A recent test of some lamps in Chicago on Michigan avenue where two blocks were equipped with "helium" lamps, placing five lamps in a cluster at a suitable elevation from the street, gave results that were simply surprising, and it is probable that a great revolution in street light-

ing will soon be effected by this method of illumination. In other words with the centers of light at very short intervals and with lamps placed at the four corners of the street intersections better lighting conditions would be had.

L. H. WEISSLEDER, Cincinnati, O.

FORM FOR REPORTING CONCRETE WORK.

In response to the request for forms used in daily reports of concrete work, W. A. Bruce of Indianapolis sends the following, one of which is turned in each night for each job on hand:

Contract No..... .....190..
Mr.....
.....

	Hrs.	Rate	Amount	Work Done
Foreman				Curb
Foreman				Gutter
Timekeeper				Curb,Curb
Finishers				& Gutter
"				Sidewalk
Form setters				Drivew's
Laborers				
"				
Teams				

MATERIALS

	Cement	Stone	Sand		
Received					
Used					
Transfer to					

..... Foreman
..... Timekeeper.

THE RELATIVE COST OF GAS USED FOR STREET LIGHTING.

The actual reduction in the cost of gas used for street lamps without meters as compared with metered gas is a matter of frequent debate but authoritative figures on a large scale sufficient for a fair average appear to have been lacking until the recent suit of The Consolidated Gas Co., vs. the Attorney General and others of New York usually referred to as "the 80 cent gas suit" disclosed them.

It should be remembered that the street lamps, care, lighting, extinguishing and repairs in New York are covered by separate estimates and that for open flame posts this is estimated at about $5.00 per year and for mantle or incandescent light at about $12.00 per year in addition to the cost of the gas used.

In what follows these sums are excluded from consideration.

The references given are to the printed testimony in the hearing before the Master in Chancery—some 10,000 or more pages in extent.

Refer to City Exhibit 60, page 1404c.

Manhattan lamp days—163,134 open flame.

Manhattan lamp days, 6,056,995 Welsbach.

Manhattan lamp days, 4,380 Cluster.

Manhattan lamp days, 40,809 Street Signs.

The Bronx lamp days, 2,120,119 Welsbach.

Total 8,385,437 all kinds.

Divide by 365 days (average) 22,974 lamps.

The Cluster lamps 4,380 divided by 365 and then by 2 or more will reduce the 22,974 lamp posts by something less than 6 lamp posts, but this is insignificant.

At the least the Consolidated Gas Co. in 1905 presented bills for 22,968 average posts lit, and thus was not required to use 22,968 meters; selling gas on an estimate for street lighting.

These bills were checked and approved by C. F. Lacombe, Chief Engineer, Light and Power, City of New York.

22,968 meters are saved by the Con. Gas Co.

Refer to City Exhibit 87, page 1490:

Gas sold to street lamps 270,779,677 cu. ft.

Divide this by 22,963 street lamps posts, we have 11,789 cu. ft. consumed annually by each lamp post, which, if metered, billed and collected in the usual way, would have cost the Consolidated 53½ cents per thousand cu. ft., or $6.31 at the post.

Refer to City Exhibit 87, page 1453:

The average number of meters in use in 1905 was 382,108.

As the street lamp gas is not metered, billed and collected for, there are certain meter expense accounts which do not exist in street lighting.

City Exhibit 87, page 1445:

Collecting meter bills.

Branch office expenses.....		$423,939.22
Stove collecting	$ 1,904.31	
Stoves	13,324.32	15,228.63
Chargeable to meters.....		$408,710.59
Expense Meter Shops.....		41,162.18
City Exhibit 87, page 1446:		
Setting meters		22,559.77
City Exhibit 87, page 1452.		
Repair to meters.....		172,925.52
City Exhibit 87, page 1452:		
Meter repair shop repairs...		4,955.52
Meter repair shop repairs..		2,440.11
City Exhibit 87, page 1459:		
Meter Dept.		9,256.74
Total		$672,019.65

Divide this by 382,108 meters obtaining $1.76 per meter from accounts directly charged to meters, although it might be correctly assumed that all general expenses are divided by meters (See Finances of Gas and Electric Light and Power Enterprises, page 443).

The saving on each omitted meter being $1.76 it is that amount on each lamp post consuming 11,789 cu. ft., or dividing $1.76 by it, we obtain a saving of 15 cents upon the cost of each one thousand cubic feet of gas consumed by a lamp post.

If we subtract this from 53½ cents, the average cost of gas, we obtain 38.5 cents per thousand for the cost of unmetered gas at the lamp post tip.

If we deduct this 15 cents from the price, 80 cents per thousand to private consumers, the price of gas to the city lamps should be 65 cents per thousand.

If 22,968 meters, costing to operate $1.76 each, and totalling $40,424 operating expense, has been used for the lamp posts, there would have been an increase of three tenths of one cent per thousand in the cost of making and delivering the 13,283,164,000 cubic feet of gas sales of the Consolidated Gas Co., of New York for the year 1905.

The average annual sales per house meter installed by the Consolidated Gas Co., are 35,000 cubic feet, making the cost of metering, etc., about 5 cents per thousand for private consumers.

The New York State Legislature in 1905 fixed the price of 22 candle power gas to private consumer at 80 cents and to the City at 75 cents making 5 cents difference in favor of the City of New York.

These figures will give some additional light on the problem of differential prices for gas, which has usually been solved by dividing all the operating expenses except productive labor and raw material by the number of meters and fixing the amount thus chargeable for each meter.

WM. D. MARKS, Ph. B., C. E.
New York City.

COMPARISON OF ELECTRIC LIGHTING SYSTEMS.

As per your request I will attempt to give you a brief history of our municipal electric light plant. The first installation was made, after serious opposition by the local gas company, who had a contract to light our streets with gas lamps, during the year 1885 by installing four Fort Wayne (Jenney) 25-ampere generators and placing seventy-five 2,000-c. p. open arc lamps on our streets, operated by one 125 h. p. Ideal engine. This system was changed to the enclosed arc and operated by No. 12 General Electric Brush 6.6 amp. generator with capacity of 120 2000-c. p. lights, purchased and installed during the year 1899. During the year 1906 this system, while giving satisfaction, was found to be too small for the requirements of the rapid growth of the city and after recommendation of the superintendent as to duplicating present engine and generator or the installing of the then new system known as the luminous arc or magnetite system and using the same engine, the latter was adopted, and the purchase was made covering one No. 13 Brush arc (General Electric with capacity of 200 2000-c. p. lights) and 150 magnetite lamps costing $6,625.00.

A brief reference to the annual reports of the three systems may be of some interest to you. While there was but little information obtainable in reference to the first installation, from the annual bills I have concluded that the cost of operating the 75 lamps was something above $80.00 per lamp and from indicator card taken from engine just previous to the change to enclosed arc I get the following: 78 lamps, 25 amp., i. h. p., 115.

The enclosed arc cost to operate $56.00 per lamp and from same engine as above 116 lamps, 6.6 amp., were operated with i. h. p., 101.

While the magnetite system has been in operation only four months, from the monthly reports I deduce that this lamp, while being 25 per cent. more efficient or giving 25 per cent. more light will only cost $47.00 per lamp per year and there are operated from the same engine 132 lamps, 4 amp., with i. h. p., 78.6.

From the foregoing we must conclude that the engine has improved most wonderfully by age or that this new lighting system is a perfect success. I now have 146 lamps in service and contemplate increasing this to 155 lamps with same engine. These lamps have given perfect satisfaction and have averaged 180 hours burning for each electrode and we find that the lamps burn out very uniformly, as report from lamps burning out even after 180 hours is an exception.

W. T. BLACKBURN,
City Engineer and Superintendent of Municipal Electric Light and Water Works, Paris, Ill.

WATER SUPPLY AND REMOVAL

Jersey City Water Supply—Wisconsin Municipal Ownership—Madison Water Works—Damages for Overflow—New Jersey Supplies—Calumet Drainage Canal—Knoxville Bond Issue—New Orleans Sewer and Water Board.

Cost of Jersey City Water Supply.

A decision rendered by Vice Chancellor Frederic W. Stevens provides that the city of Jersey City, N. J., must pay at the rate of four and one-half per cent., $391,775 annually, for its water supply, pending the settlement of the suits which the city has brought against the water company. The city has been paying at the rate of four per cent. on the original cost price, an amount of $353,000. annually. The water company built the plant expecting the city would buy it for $7,595,000. The city decided to fight the company on technicalities and the alleged failure properly to protect the supply from contamination. The company now avers that under the terms of the contract if the city wants to purchase the plant it will have to pay $400,000 more than the first price, or $7,995,000.

Municipal Ownership in Wisconsin Cities.

Municipal ownership of water-works plants was defeated in four cities in Wisconsin recently. Manitowoc defeated a proposition to purchase the present plant for $230,000. Racine found it impossible to get brokers to take city bonds for $410,000 for a municipal water-works plans. Sheboygan experienced the same trouble that Racine did, the price of the plant there being $400,000. The supreme court rendered a decision fixing a rate for service so low that the citizens of Appleton will drop the agitation for a municipal plant.

Madison, Wis., Water-works Anniversary.

The water-works plant of Madison, Wisconsin, was 25 years old October 11, and the occasion was referred to by local papers as its silver anniversary. It was built at a cost of $95,000 and up to the present time nearly half a million dollars has been invested in it. At the time of the construction of the plant 11½ miles of water mains were laid, but each year brought an increasing demand for water service and now the total mileage of mains aggregates 49½ miles. John B. Heim, who at the time the plant was built was the youngest member in council and led in the fight for municipal ownership of the plant, has been superintendent of water-works continuously with the exception of one year, since the inauguration of the plant.

Damages from Water Company for Overflow Caused by Dam.

A jury verdict for $25,000 was brought in September 26 for the Woodstock Hardwood & Spool Company in its suit against the Charleston Light and Water Company, of Charleston, W. Va. The plaintiffs asked for damages of $45,000 because of injury done their business by the overflowing of land between their timber tracts and manufacturing plant, causing them to abandon the manufacturing of their products and to move to Charleston. The damming of Goose Creek by the Charleston Light & Water Company in 1905 caused this overflow.

Water Supplies of New Jersey.

A two days' tour of inspection of the water sheds of northern New Jersey was completed by the members of the State Potable Water Commission October 19, and it is said that in their report to Governor Stokes November 31 they will recommend the conservation of the water supplies in part of the state in which Newark is located. The plan looked upon with the most favor is said to be that proposed by the Flood Commission, and will serve the two-fold purpose of protecting the potable waters and providing against floods in the territory in question. The Flood Commission proposed that a dam be built across the Pompton River at

Mountain View, and a reservoir, covering an acreage of 18 square miles, constructed over the Pompton plains. Another reservoir site under consideration is that of the "Great Piece," over the Pine Brook flats, as suggested by tthe geological survey. The acreage of this proposed lake is 50 square miles, reaching from Little Falls almost to Chatham. Its maximum depth, however, would be but 25 feet, while the Pompton Lake would measure as deep as 55 feet, with the result that the capacity of the two reservoirs, as estimated by Morris R. Sherrerd, chief engineer, would be the same. The potable water commissioners considered the latter site, therefore, the more practicable of the two from an economical point of view. The practicability of constructing a series of reservoirs in the Ramapo Valley was also inquired into, but the commissioners looked upon this scheme with little favor.

Much attention was directed by the commission to the Pompton feeder of the Morris Canal with a view of ascertaining whether the canal management is diverting any of its water supply to the benefit of the East Jersey Water Company.

A Drainage Canal for the Calumet District in Chicago.

The construction of the Calumet-Sag canal, as the most desirable method of disposing of the sewage of the Calumet and Chicago districts, is proposed by Rudolph Hering, consulting engineer of New York City. He proposes a scheme by which the water level of the great lakes will not be lowered by such a canal, thereby answering the principal objection to it urged upon Congress and the War Department by the international water ways commission. Mr. Hering's report was made to the sanitary district board. He prefers the proposed canal to the sprinkling filters, which, it is estimated, would cover eighty acres for a population of 600,000. He urges that their use in a northern climate has not been demonstrated as satisfactory. In addition he shows that the annual cost of the filters, counting interest on investment, depreciation and cost of operation, as compared with the proposed canal, is much higher after the population of the Calumet district reaches 400,000. He estimates that the population of the district will be 300,000 before a canal could be completed, and for that number of persons the annual cost of the filters including operation and fixed charges, would be $360,240, and for a population of 1,200,000 it would be $900,300. The annual cost of the canal for 300,000 population he figures at 655,900, and for 1,200,000 population at $763,700. But the latter does not take into account the earning power of the canal in the sale of water power, which he unqualifiedly asserts should remain an asset of the canal.

The federal law now permits a maximum flow of 10,000 cubic feet per second into the drainage canal, and Mr. Hering estimates that 4,000 more cubic feet would be required to supply the Calumet-Sag canal. This additional 4,000 cubic feet flow would create revenue from the power plant at Lockport to reduce the annual cost of the Calumet canal to $384,100 for a population of 300,000 and to $490,900 for a population of 1,200,000. With power plants at Lockport and Joliet he figures the annual cost of the canal for 300,000 population at $128,800 and for 1,200,000 population at $235,600.

The Lockport plant is already constructed so that the annual cost of the Calumet Canal for 300,000 population is $384,100 as against $360,240 for the sprinklers, and for 1,200,000 population the canal would cost annually but a trifle over one-half of the cost of the sprinkling filters.

The water way commission has estimated that a flow of 14,000 cubic feet a second from Lake Michigan would lower the water level between six and eight and one-half inches. To restore the original depths to the water it has estimated that it would cost the government $12,500,000. It has made no objection so far to the diversion of 10,000 cubic feet, but does object to allowing a diversion of an additional 4,000 cubic feet.

To prevent the lowering of the water level of the lakes Mr. Hering proposes that Lake Superior shall be made a reservoir for the storage of water, which shall be permitted to flow into Lake Michigan in dry times. This plan, he asserts, is feasible and practicable, and declares it would prevent the lowering of the water level of the lakes.

Mr. Hering says that the scheme of the international water ways commission for regulating works at Sault Ste. Marie to keep a storage of water in Lake Superior has his approval except that he desires the storage capacity of Lake Superior made one-sixth greater. The commission has recommended that the low-water level of Lake Superior be 601.7 feet above tide, and that the

regulating works at Sault Ste. Marie be so constructed as to permit of a high water level of 603.2, or an increase of eighteen inches. If the high-water level is placed at twenty-one instead of eighteen inches above its low-water level Mr. Hering asserts that the water level of the remainder of the great lakes system will not be lowered by the diversion of 14,000 cubic feet a second into the Mississippi Valley at Chicago for drainage purposes.

In conclusion the engineer urges consideration of the Calumet-Sag canal as a navigable water way between Lake Michigan and the present sanitary and ship canal at Sag. He recites the fact that the tonnage of the Chicago River has remained almost stationary for eighteen years, while the annual tonnage of the Calumet River has rapidly increased until it is now about half that of the Chicago River.

He argues that reversing the current of the Calumet and permitting large quantities of lake water to flow up the stream would materially reduce the amount of dredging necessary for navigation in that water way. He claims that General O. H. Ernst, the government engineer in Chicago who opposes permitting the diversion of 4,000 additional cubic feet of water from the lake, indorses his view of dredging.

New Orleans Sewer and Water Board.

The fifteenth semi-annual report of the Sewerage and Water Board, of New Orleans, La., shows the ground site and some of the structures of the water purification station, which occupy some twenty-eight squares of ground in upper Carrollton. The report contains a series of maps showing the sewerage, water and drainage systems, completed and under course of construction, and dwells generally on the progress of the systems. In the matter of drainage the biggest piece of work is the dredging of the outfall from Algiers pumping station and the building of a canal fifty feet in width and ten feet in depth, at a cost of $66,000, to serve both as drainage and navigation canal. Its outlet is in Bayou Barataria. An appropriation of $10,000 was expended on enlarging Claiborne and Carrollton avenue canals, and about $25,000 will have to be expended in placing the I-beams in concrete in all drainage canals that are covered. In sewerage work the sum of $351,144 has been expended during the last six months. The board endeavored to get reasonable bids for the completion of the remaining 110 miles of sewers to be built, but only received two bids on the final sewer contracts. Both bids were too high and were rejected, and in view of the condition of the labor field, which contractors hold responsible for the high prices that prevail, the Board has concluded not to advertise for bids on the 110 miles of sewers until conditions are more favorable.

Knoxville Bond Issue is Constitutional.

The supreme court of Tennessee held, September 28 that the $180,000 bond issue of Knoxville is constitutional. The act was passed by the last legislature and provided for the issue of the bonds for the payment of floating debts of Knoxville and for building sewers.

Curb and Gutter Question in Ft. Smith, Ark.

The question of the right of the paving commission to compel property owners to put in the combined curb and gutter selected by that commission has resulted in bringing about considerable debate at Fort Smith, Arkansas. One attorney has rendered an opinion to the effect that the paving commission has no such right, and that the commission can be enjoined from enforcing any resolution directing the placing of the curb and gutter which may be adopted by council. Some of the aldermen are in favor of adopting such a resolution and then forcing the property owners to begin litigation. One attorney has guaranteed to have the improvement board enjoined permanently for a fee of $500 and the indications are that the fee will be raised and an injunction applied for. It is claimed, again, that the law empowers an improvement board to change the assessments as conditions demand, and that if the property owners refuse to put in the gutters, the commission will pave to the curb and charge the additional expense to the abutting property. In response to this argument the opponents of the combination curb and gutter say that the law prohibits an assessment greater than 20 per cent. of the property valuation, and as the assessment has been made on that basis, the improvement board cannot make an assessment for the additional paving should it be compelled to pave the street from curb to curb, and that a cement curb can be put in at much less than 35 cents a foot. In order to come within the estimate it is believed that the paving commission will have to reduce the number of miles of street to be paved.

ORGANIZATIONS AND INDIVIDUALS

Dissolution of Cement Company—Newark Librarian—Fire Engineer's Association—Water Works Association—Technical Meetings—Civil Service Examinations—Personal Notes.

Dissolution of Cement Company.

Notice of the dissolution of the Western Cement Company, of Louisville, Kentucky, has been given by the secretary of the company, to take effect November 7. In the notice sent out by Secretary Courtenay he states that the dissolution follows a decline in the demand for hydraulic cement. At the same time, as stated, the Portland cement trade has reached such proportions that it is almost impossible for the mills to supply the demand. In addition to acting as sales agent for the hydraulic mills in its territory the Western Cement Company has at the same time acted in that capacity for Speed's Portland cement, which is manufactured at Sellersburg, by J. B. Speed and associates who, a few years ago, built a Portland cement plant at that place. The Western Cement Company controls the nineteen mills in Clark county, Indiana, which furnish the greater portion of the hydraulic cement sold in the United States and, as a result, fix the price for the commodity. The dissolution of the Western Cement Company, will, therefore, prove disastrous to many of the smaller mills connected with it. The officers of the Western Cement Company are, President, J. B. Speed; vice-president, R. A. Robinson; secretary and treasurer, T. A. Courtenay.

Fire Engineers' Association.

The thirty-fifth annual convention of the International Association of Fire Engineers was held in Washington, D. C., October 8, 9, 10 and 11. Among the papers submitted were the following:

"Are Shingle Roofs in Cities Conflagration Hazards," Chief T. W. Haney, Jacksonville, Fla.; "Fire Protection for Private Corporations," Herbert Hester, Fire Marshal P. R. R., Philadelphia; "Is Fire Prevention of More Importance than Fire Protection," H. C. Henley, Chief Insp., St. Louis Fire Prevention Bureau; "Fire-Boat Protection," Chief Edw. F. Croker, New York City; "Extinguishing Fires in Cellars and Subcellars," Chief C. E. Swingley, St. Louis; "Electric Fires—Their Cause and Prevention," W. H. Merrill, Secy. Nat'l Fire Protection Assn.; "What Are the Dangers of Carbon Bisulphide in Liquid Form, and the Best Methods of Handling and Storing It?" Chief J. R. Canterbury, Minneapolis.

Among the topics for formal discussion were the following:

"Faulty Building Construction"—from the fire standpoint; "The Advisability of Using Explosives to Check Conflagration;" "Transportation of Fire Apparatus in Event of Sending Aid to Other Cities;" "Should Telephones be Installed in Fire-Alarm Boxes?" "Shut-Off Nozzles on Engine Streams;" "The Use of 3-inch Hose."

The next convention will be held in Columbus, Ohio. Vice presidents for the various states were selected as follows:

District of Columbia, William T. Belt; Alabama, J. F. Browder; Arkansas, Charles S. Hofer; California, P. H. Shaughnessey; Connecticut, H. W. Parker; Colorado, E. E. Baty; Florida, Tucker Savage; Georgia, W. B. Cummings; Illinois, F. A. Owen; Indiana, James Denaley! Iowa, Thos. J. Price; Kansas, John McNarrey; Kentucky, J. J. Wood; Louisiana, Chris O'Brien; Maine, M. N. Eldridge; Massachusetts, George Coleman; Maryland, Malcolm W. Jordan; Michigan, Hugo R. Diefs; Minnesota, W. C. Worton; Missouri, John O. Glanville; Mississippi, M. H. Duncan; Manitoba, Canada, J. E. Buckhannon; Nebraska, D. C. Garratt; New York, Charles Little; New Jersey, George Warratt; New Hampshire, W. C. Green; North Carolina, Charles Schniffey; North Dakota, A. H. Runge; Ohio, Charles J. Lauer; Ontario, Canada, John Thompson; Oklahoma and Indian Territory, J. L. Templeton; Oregon, David Campbell; Pennsylvania, James Gallagher; Quebec, Canada, Z.

Benoit; Rhode Island, A. J. Kiwin; South Dakota, Charles Arenat; South Carolina, E. S. Kennedy; Tennessee, C. T. Sullivan; Texas, A. M. Prescott; Utah, Charles T. Vale; Vermont, C .A. Niles; Virginia, George C. Shaw; Wisconsin, O. Johnson; West Virginia, Robert Cline; Wisconsin, William Mertz; Wyoming, Otto Gramm; Delaware, George W. Sosse.

Newark's Municipal Librarian.

Mr. Edward Watson Whitehead has been appointed municipal librarian of the newly established library in the city of Newark, New Jersey. Mr. Whitehead was born in Newark about forty-eight years ago, and has resided

EDWARD WATSON WHITEHEAD.
Municipal Librarian, Newark, N. J.

there all of his life. For many years he has been closely identified with various interests of importance in his native city, and for more than twenty-five years has been active in political matters pertaining to the democracy of his city, county and state. He has also been actively engaged as a newspaper correspondent for a number of New Jersey papers during the last fifteen years and has been the author of several important matters bearing on municipal affairs.

The municipal library at Newark is an important department of the city government and is located on the fourth floor in the new City Hall, at Broad, Franklin and Green streets. It is a bureau of information and exchanges of municipal reports are to be yearly made with all large cities in the United States and Europe.

Central States Water Works Association.

At the recent convention of the Central States Water Works Association held at Wheeling, W. Va., water filtration, municipal ownership of public utilities and the disposition of garbage received considerable attention. A paper presented by John W. Hill, chief engineer of water-works at Cincinnati, Ohio, on "Municipal Ownership of Public Utilities," in which he opposed municipal ownership, aroused considerable discussion, it being charged that it had a political tinge and was unfair to the cause of the association. Mr. Hill was unable to be present and his paper was read by clerk Brown. The paper treated, in the introductory remarks, of the necessity of municipal ownership of certain utilities, but could see no reason why a water plant should come under the head. He stated that a private corporation can make a dollar go farther than a municipal power, and while the latter may operate a plant efficiently there is no doubt but that a private corporation could do as well or better. Reasons for such a belief he gave as the greater weight of a private contract, the less troubles with labor and the engineers found a better field for their work under the directions of a private corporation. The practice, too, of having an inefficient man in office because of his political pull, who follows a policy private ownership would never have endorsed, was cited, though the speaker hastened to assure his hearers that he believed public officials has as great honesty as private officers in similar positions.

The lavish expenditure of money by municipalities who owned their plants, the collusion often affected by contractors in dividing up public contracts, and the frequent changes in officials through political changes and not inefficiency were cited also. The paper too, quoted liberally on the recent address of Secretary Taft in his opposition to municipal ownership. The opportunities for graft were cited and in closing the speaker stated he believed than street cleaning, sewerage and the collection of garbage should be looked after by the municipality, but the water, light and trolley

lines should be intrusted to private interests.

In the discussion that followed Mr. A. L. Holmes, of Grand Rapids, stated he believed that the position of the private corporations toward the people was what had fostered the municipal ownership idea and the solution lay in the municipality having an interest in its private corporations caring for public utilities.

Technical Meetings.

A joint convention of the American Civic Association and the National Municipal League will be held November 19, 20 and 21, at Providence, R. I. Clinton R. Woodruff, secy., North American Bldg., Philadelphia.

The 33d annual meeting of the New Jersey Sanitary Association was held at Atlantic City, N. J., Oct. 1 and 2, in connection with the American Public Health Association. Officers for the ensuing year were elected as follows: President, John B. Duncklee, M. Am. Soc. C. E., South Orange, N. J.; secretary, Dr. James A. Exton, Arlington, N. J.; treasurer, George P. Olcott, C. E., East Orange, N. J.; chairman executive council, Prof. John B. Smith, New Brunswick, N. J. The next meeting will be held in Lakewood, probably in December, 1908.

The 35th annual meeting of the American Public Health Association was held at Atlantic City September 30 to October 4. The papers submitted include the following: "Effect of Wind-Currents on Pollution in a Great Lake," by John A. Amyot, of Toronto; "Normal Waters of Illinois," by Edward Bartow, of Urbana, Ill.; "Experiments on Disinfection of Sewage and Sewer Filter Effluents," by Prof. Earle B. Phelps, of Boston, Mass.

At the meeting of the Philadelphia section of the Illuminating Engineering Society October 18, a paper on "Fixture Design from the Standpoint of an Illuminating Engineer," was was read by V. R. Lansingh and C. W. Heck. The design of illuminating fixtures was considered with three considerations always in view, as follows: (1) Elimination of bright sources in the field of vision; (2) artistic treatment and definite motive of design; (3) economy and good illumination. The field of fixture design was divided into two classes; one dealing with bracket and ceiling fittings, the second with chandeliers and portables. The first division alone was treated in the paper presented and the second was left for a future discussion. The faults of some present types of fixtures were shown with suggestions for improvement along the three lines mentioned before.

The second annual meeting of the American Gas Institute began at the New Willard Hotel, in Washington, D. C., October 16, with more than 500 members and delegates present. The first morning session was devoted to a report of the institute's board of directors, a report of the trustees of the "gas educational fund," an address by Charles H. Dickey on "Obligations Imposed by the Possession of Franchises" and the annual address by the president of the organization. During the sessions other papers submitted were as follows: "Depreciation," by Dr. A. C. Humphreys; "Report of the Committee on Methods of Taking Candle Power of Gas," by W. H. Hartley, chairman; "Air Blast Gas Appliances," by W. K. Eavenson; "Discussion of Report of Committee on Meters," by W. J. Serrill; "Experience With Dipping Diaphragms in Philadelphia," by W. A. Castor,; "Experience with Dipping Meters in Baltimore," by George Beadenkopf; "A New Carbonic Acid Gas Indicator," by Charles D. Robinson.

The annual convention of the International Sprinkler Company representatives was held at Atlantic City, N. J., September 24 and 25. The members discussed improvements and sales methods of automatic sprinklers. A. W. Lewis, of Philadelphia, is general manager.

The next convention of the League of California Municipalities will be held in Pasadena commencing November 11.

Civil Service Examinations.

The U. S. Civil Service Commission will hold examinations at the usual places on November 13 for constructing engineer in the Forest Service in the West at $1,500 to $2,000 a year and for assistant technical editor in the Geological Survey at $115 a month.

Milwaukee Paving Case Decided.

The Wisconsin supreme court rendered a decision, October 15, sustaining Judge Tarrant in his refusal to set aside an injunction restraining the city of Milwaukee from collecting taxes to pay for several blocks of bitulithic pavement constructed by the Central Bitulithic Company. Council ordered the paving June 12, 1905, of Clybourne street, from Seventeenth to Twentieth streets. The abutting property is owned by the Cawker estate,

and Mrs. Cawker and the executors of her husband's estate resisted payment of the taxes. The board of public works later accepted the work and issued tax certificates against the property. The estate refused to pay, claiming that the paving contracts were void because made in violation of the charter of the city of Milwaukee because the right to lay a pavement of th character described in the specifications is patented and no person could safely bid for the doing of such work unless he had purchased from the owners the right to do so. It was alleged that there was no competition, and that the three unsuccessful bids were submitted by subsidiary companies of the Central Bitulithic Paving Company.

Personal Notes.

James S. Brown was inaugurated mayor at Nashville, Tenn., October 14.

Col. W. R. Crabtree was inaugurated mayor, at Chattanooga, Tenn., October 14.

Hon. John Johnson, mayor of Paterson, N. J., died recently, after a week's illness.

Harry Schley Sanderson has been appointed supervisor of city lighting, at St. Louis, Mo., to succeed Thomas B. Carter.

Newton Woodruff has been appointed water clerk, at Newton, N. J., to succeed Stephen P. Vreeland, who resigned.

Walter D. Pease, water commissioner of Cheyenne, Wyo., and former city engineer of that city, died recently aged 73 years.

Hon. Hadley C. Clapp, ex-Mayor of Brewer, Me., died at his home in that city October 9, of Bright's disease, aged 46 years.

John Schultz has been appointed assistant city engineer at Seattle, Wash., and will have in charge the bridge work of the city.

Thomas Beveridge, former mayor of Paterson, N. J., died suddenly of heart failure at his home in that city October 17, aged 67 years.

William Lamson, Brooklyn, N. Y., has been appointed assistant engineer on the staff of the New York City board of water supply.

Sir John Charles Bell has been elected Lord Mayor of London, to succeed Sir William Treloar, Bart. He will be installed in office November 9.

Warren J. Frank, surveyor and former assistant city engineer at Bloomington, Ill., died suddenly of heart disease, September 30, in that city, aged 35 years.

Oscar Edwards, city engineer of Roseburg, Wash., and county surveyor of Douglas county, Wash., has been appointed city engineer of St. John, Wash.

F. J. Boland, city engineer of Hanford, Cal., has been appointed chief engineer of an electric railway line that is to be built in the vicinity of that city.

W. W. Sisson has been elected to the vacancy on the board of water commissioners, at Binghamton, N. Y., caused by the death of B. S. Curran, October 3.

Samuel Whinery, consulting engineer, New York City, has been engaged by the finance commission of Boston, Mass., to investigate the street paving problem in that city.

Washington Paulison has resigned as superintendent of the Acquackanonk (N. J.), Water Company, and has been succeeded by W. C. Hopper, of the Passaic Water Company.

Enoch H. Towne, city clerk of Worcester, Mass., for nearly 31 years, has resigned on acount of ill health, and his son, W. Henry Towne, has been elected to succeed him.

Colonel Joseph L. Wickes, who was appointed commissioner of street cleaning of Baltimore, Md., four years ago by the late Mayor, Robert M. McLane, has been re-appointed by Mayor J. Barry Mahool.

Benjamin T. Fendall has been reappointed city engineer, Alfred M. Quick water engineer and president of the water board, Oscar F. Lackey harbor engineer and president of the harbor board, at Baltimore, Md.

Clarence W. Hubbell, M. Am., Soc. C. E., civil engineer to the board of water commissioners at Detroit, Mich., has resigned to go to Manila, P. I., to take charge of the water system of that city. He will be succeeded in Detroit by George H. Fenkel, at present civil engineer of the water department at Erie, Pa.

Arthur B. White, Assoc. M. Am. Soc. C. E., and William F. Bixby have organized the firm of Bixby & White, civil and hydraulic engineers, with offices in the San Fernando Bldg., Los Angeles, Cal. The firm will make a specialty of structural steel and reinforced concrete construction, irrigation and sewerage systems.

John Severin Branne, Assoc. M. Am. Soc. C. E., has resigned as secretary and chief designing engineer of the James E. Brooks Co., consulting engineers, 45 Broadway, New York City, and established an office at 1 Madison Avenue, New York City, where he will make a specialty of bridges, buildings and general structural work.

Dr. Willis G. Tucker, professor of chemistry and toxicology in the Albany Medical College, Olin H. Landreth, professor of engineering in Union College, and James H. Stoller, professor of biology in Union College have established the Albany Sanitary Bureau at Albany, N. Y., for the investigation of sanitary problems, including water supplies, sewerage, sanitary conditions of cities, towns, factories, institutions, etc. They have had years of experience with the work in connection with the New York State Board of Health and together cover the entire field. Dr. Richard M. Pearce is consulting bacteriologist of the bureau.

MACHINERY AND TRADE

The Bitulithic Exhibit.

The Bitulithic exhibit at the Detroit Convention of the A. S. M. I. was largely of the men engaged in the business and it was an excellent showing. It was in charge of G. M. Ingram, president of the Southern Bitulithic Co., and showed the kind of help the company has in doing the vast amount of work which it secures every year. To build up a business of millions of yards a year in scarcely more than six years is phenomenal and could only have been done by the co-operation of competent men all along the line.

There was a handsome set of views of Bitulithic pavements in Birmingham, Ala., in addition to the regular package of advertising literature. One of these views is reproduced herewith. The society had the pleasure and profit of traveling over some of these streets at the convention in 1906.

THE BITULITHIC PAVEMENT ON HIGHLAND AVE., BIRMINGHAM, ALA.

Cast Iron Culvert Pipe.

Feltz and East, Lima, Ohio, offer their improved cast iron culvert and sewer pipe, believing it to be simple and practical in construction. It is made in all regular sizes from 10 to 48 inches diameter and in sections 3 and 4 feet long.

All sections fit closely and interlock with each other both sideways and endways. The following claims are made by the manufacturers: The bulkhead attached to the end sections of the pipe, successfully takes the place of a retaining wall of stone or concrete. The lower flange of the bulkhead extending into the ground prevents the water from undermining the pipe. The flat bottom holds the pipe firmly in position—keeps it from sinking or settling. All sections interlock with each other, from end to end, so firmly that it is practically impossible for the ends to drop.

There is sufficient play-space in all connections to expand and contract with the temperature and the culvert can therefore not crack or be injured by freezing. The re-inforcing ribs add to the strength and keep the pipe from being dislodged or washed out. The culvert is easy and convenient to ship, easy to load and unload, easy and convenient to haul, easy and most convenient to handle and the usual high expense of putting culverts in place is therefore very much reduced.

Bitulithic for Chicago Boulevards.

After full argument of counsel Judge Mack, in Chicago, refused to grant an injunction suit in the case of The Barber Asphalt Paving Co. vs. The South Park Commission and the Chicago Bitulithic Co., in which it was sought to annul the contract for laying Bitulithic on Michigan and

South Park Avenues and 33d street in the boulevard system, letting of which was announced in the October number of MUNICIPAL ENGINEERING. Part of the work is already completed and open to traffic and the court refused to interfere with the progress of the remainder.

Recent Waterproof Concrete Structures.

The Sandusky Portland Cement Co., Sandusky, O., manufacturers of Medusa Water-proof compound, report that that that material was used in the following work: Concrete foundations and cement plaster coat on the light well in the new concrete office structure known as the Pacific Bldg., San Francisco; in the construction work in the new plant for the District of Columbia Paper Mfg. Co., Washington, D. C.; by the Aberthaw Construction Co., in concrete tanks and water filter for the Woronoco Paper Co., near Boston, Mass.; for stopping leaks in the Illinois Tunnel Co.'s concrete subway work, Chicago, Ill.; and by James Stewart & Co., contractors, in the Linoleum plant constructed by them at Lancaster, Pa.

Indiana .Freight Rates on Road Materials.

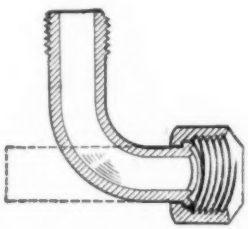
A meeting was recently held by the Indiana Railroad Commission to consider the matter of an even schedule of rates on all steam roads for gravel and road materials. A number of railroad men met with the commission in Indianapolis, among those represented being the following: The Lake Shore; G., R. & I.; E. & I.; Monon; E. & T. H.; Southern Indiana; C., H. & D.; L., E. & W.; W., C. & E.; Pennsylvania; Wabash; Illinois Central; Big Four; C., I. & E.; Vandalia; C., C. & L.; Indianapolis Southern; B. & O.; Indiana Harbor; L., N. A. & C., and others.

Witnesses testified that because of varying physical and other conditions it will be impossible to make a schedule that will apply fairly to all roads in all parts of the state. Representatives of some roads stated that they gave special rates on road materials because it was to their interests to make inducements for good roads so that business can be hauled to the stations for shipment at all seasons of the year, and with the least difficulty. The railroads transport half a million yards of gravel and crushed stone annually for road and street making purposes and as this traffic is handled in the summer in coal cars which would not be used for anything else at that season it can be hauled at a lower rate than otherwise.

A petition has been filed in the superior court at Lafayette, Indiana, by the railroad commission asking for an order to restrain the commission from putting into force an order regulating the rate that shall be paid the Monon railroad for handling gravel for the Lafayette Concrete Company. The Monon has been charging this company about $1¼ a car for handling the gravel between the pit, which is located south of Lafayette along the tracks of the Monon, and the junction. The railroad commission has decided that this rate is too high and has fixed a new rate which is expected to go into effect soon. This rate is $5 for single cars and $4 each for two cars. The railroad company claims that it is impossible to handle a car for that amount of money and pay the wages of its men.

The Teksagon Coupling.

Mr. W. H. Clark, 1512 Broadway, Mattoon, Ill., is well known among the older water companies by reason of his



THE TEKSAGON METER COUPLING.

meter box, which has been largely used. He has recently invented and put on the market a meter coupling under the name of Teksagon.

More than one person has wondered what a Teksagon was until they were directed to reverse the letters, whereupon the words stood out plainly as "no gasket." That is the secret of the Teksagon, which operates effectively and makes a water-tight joint. Mr. Clark says: "The use of the gasket was more or less of a bother. The waterway was choked owing to the compressing of the gasket, there being no shoulder to retain it, reducing the flow through the meter in some cases as much as 50 per cent. With the gasket the joint would be tight at first, but would finally leak, and then a new gasket would have to be inserted; that is to say, the old style or joint required attention. The leak, of course, is caused by the wearing away of the gasket, which, in turn, releases partic-

les that get into and clog the pipe. With the Teksagon there is nothing to wear away; there are no leaky joints, because when the joint is once tight it stays tight; there are no new gaskets to be supplied; there is no attention to be paid to the joint; in the making up of joints in meter boxes and in close places, the Teksagon is very convenient and is a great time- and money saver, and the Teksagon coupling costs no more than the ordinary one. It is a distinct advance in the making of joints, and, of course, is applicable to other than water pipes." The Teksagon coupling is made in three sizes.

Rescuing the Highways.

The Revere Beach parkway was surfaced last year with the coal-tar preparation called Tarvia for the greater part of the way between Main street in Everett and Eliot Circle at the beach. This year the remaining section between Fellsway and Main street was treated. The work has lately been finished and a layer of fine screenings still covering the surface makes it seem like a newly built road awaiting the final smoothing that traffic gives. The screenings are left on the road for the sake of taking up all the tar possible and working themselves well into the mass. Upon their removal the road will have the character which the parkway presents in some of its previously treated parts.

The traffic over this parkway is intense, giving test-conditions with reference to automobile requirements as complete as could be found anywhere.

From Main street in Everett for some distance east the parkway is in excellent condition. But along towards Chelsea on the double road section the surface is badly worn in places. For a considerable stretch it is so thoroughly torn up as to be thickly scattered over with the loosened stones. This shows what a powerful disintegrating effect is exerted by the automobiles wherever defects in construction proffer the least encouragement. Yet even here the road is so well saturated by the tar as to be dustless. This lack of dust is one one of the great advantages of the treatment adopted. Nowhere on the parkway does there appear to be the least trouble from dust. No watering is required—a saving in expense so great as practically in itself to pay for the tar-surfacing, not to speak of the other advantages gained.

The defective sections, like the one afore instanced, are to be repaired and resurfaced with Tarvia. The newly treated parts of the road together with some of the sections remaining untouched since last year, could hardly be distinguished, so far as general appearance goes, from a good bitulithic pavement. Such a surface is a luxury to ride upon awheel. In other sections, fairly well preserved, are occasional "scab-holes," caused by the abrasion of the surface at places where the permeation of the roadbed was deficient. In some places the surface is very badly pitted by these scab-holes. They may have been due partly to the circumstances that the binding material was of a more or less clayey or loamy character and consequently did not permit sufficient permeation, partly because some of the work was done in September when temperature conditions were unfavorable, or when perhaps the moisture had not evaporated from the roadbed. If the macadam is either cold or humid the tar will cling to the stones and the permeation will be inadequate. It is important that the roadbed be saturated to a considerable depth with the hot tar. In that event the surface macadam is well bound together and the action of the motor-cars, however heavy they may be or rapid their movements, cannot loosen or lift it. It is therefore essential that the surface be thoroughly swept of dust and binding-material before treatment. It will probably be a comparatively easy matter to deal with these scab-holes when the second treatment is given. But care needs to be taken to avoid a hubbly surface at the repaired joints. The tar surfacing, it should be remembered, has to be done two or three years in succession, after which much less annual attention is required.

The lately surfaced section of the Revere Beach drive from Charles Eliot Circle to Revere street, is a perfect example of such a road, uniting the qualities that respectively most commend both macadam and asphalt. The first cost of such tar-surfacing is said to be but little greater than the annual cost of watering the roadway where it is applied. In respect to park roads, where watering is regularly required, the economy thus gained is manifest. In case of roads through the open country, however, such as the State highways, artificial watering is impracticable. Nature has to be depended upon for that service. But the economic benefit from the tar-sur-

APPLYING TARVIA TO COMMONWEALTH AVE., BOSTON.

NEWTON BOULEVARD, NEAR BOSTON, MADE DUSTLESS WITH TARVIA.

facing is great in that respect also. It saves the wear and tear due to the action of the elements—the drying out and the surface disintegration into dust in times of summer drought, the gullying from rains, and the upheaving action of frost in winter—as well as the destructive effects of motor-vehicles. Under ordinary circumstances a macadamized road gradually wears away until finally it has to be thoroughly reconstructed at a heavy expense. But with this treatment, steadily kept up, it is claimed that macadam can be made to last indefinitely at a very moderate maintenance cost.—Sylvester Baxter, in The Boston Transcript.

The Simplex Water Meter.

The Simplex Meter consists of a Venturi tube and two mercury columns forming a "U." From the top of one of these, a pipe extends to the full section of the Venturi tube, and from the top of the other a pipe extends to the contracted section of the Venturi tube. When the water has no velocity the mercury will be at the same level in each tube, viz., at the bottom of the one connected with the contracted section, and at the top of the one connected with the full section of the Venturi tube. When water flows through the Venturi tube the pressure is reduced in the contracted section and, therefore, the mercury will rise in the tube connected therewith, and correspondingly fall in the tube connected with the full section. In this latter tube there is an iron float resting on the mercury and suspended by a fine nickel wire which passes up through a small opening in the top of the tube, thence over a sheave and is held taut by a counterweight on the opposite side of the sheave. On the same shaft and attached to the sheave is a cam whose position therefore depends upon the location of the float resting on the mercury. A form of clock oscillates a tappet, which in its upper stroke comes in contact with the cam. The tappet rocks on a shaft, and at its opposite end is a counterweight sufficiently heavy to raise it to contact with the cam when the tappet is not actuated by a downward pull. The middle part of the tappet is forked to allow a disc wheel to revolve within the fork, and on the same shaft with the tappet. By means of a clutch composed of balls working in a V-shaped rest the tappet revolves the disc wheel on its upper stroke, and by means of another fixed clutch of similar design the disc wheel is kept from running backwards; the action being similar to that of a pawl and ratchet movement. Attached to the disc wheel is a train of gears which runs the meter register. The clock consists of an overshot water wheel run by a jet of water flowing from an orifice under a head made constant by the flow from a needle valve which automatically discharges the required quantity for all variations of pressure in the main. The flow being practically constant, it is seen that the water wheel will run at a uniform speed; but to further insure the uniformity in speed a pin escapement is attached to the water wheel, and the movement is made isochronous by means of a heavy pendulum. The water wheel is geared to a crank disc which runs a vertical connecting rod, which passes through an opening in the tappet and has ball at its top; thus the connecting rod is free to move upwards without moving the tappet when it comes in contact with the cam, and will pull the tappet downwards only when the ball in its downward course touches the tappet.

To prevent clogging up the pipe which leads from the main to the needle valve, this pipe is provided with a large screen. To dispose of the slight amount of leakage passing through the aperture containing the nickel wire, an overflow pipe is also conducted to the needle valve receptacle; so there is really no waste of water. The total amount of water used in this manner and for running the water clock amounts to only 20 cubic feet per twenty-four hours.

The contact curve of the cam is based on a formula representing the relation between the difference of level of mercury in the two tubes and the flow of water through the main, so that the meter registers the total number of gallons which has passed through the water main up to the time of reading. There is also a dial graduated in gallons, enabling the observer to note by the position of the hand, or needle, the rate of flow in the main at the moment of observation.

The valve is manufactured by the Simplex Valve and Meter Co., 112 Broadway street, Philadelphia, Pa., who will give any further particulars desired.

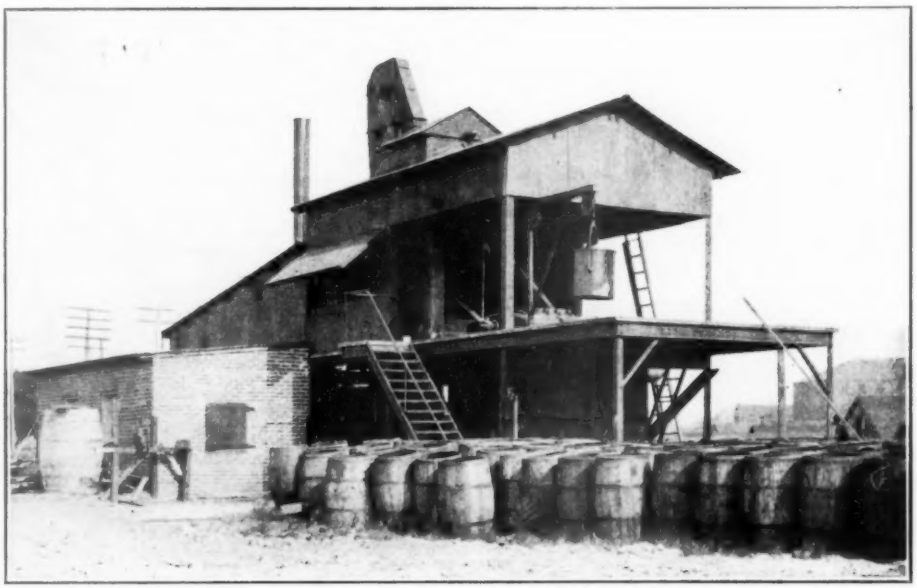
Reinforced Concrete Pipe.

One of the prominent exhibitors at the Detroit convention of the A. S.

M. I. was the Reinforced Concrete Pipe Co., of Jackson, Mich. Two sections of pipe of large diameter were in evidence in front of the Art Museum and the supply of models and advertising literature was ample. The success of this company has been remarkable. It has depended upon the value of the product and the reputation gained by the good quality of the product and the comparative cheapness have been the main factor in this success. Handsome catalogs and testimonials will be sent on request.

The Dayton Asphalt Repair Plant.

The accompanying illustration shows the asphalt repair plant which was installed in the City of Dayton, Ohio, last month and by means of which that city is now busily at work putting all of its defective asphalt streets



THE DAYTON, O., ASPHALT REPAIR PLANT.

in proper repair. This plant is adapted for the manufacturing of mixtures for the repairing of bituminous macadam, bitulithic or asphalt streets and was built and installed by Hetherington & Berner, of Indianapolis. It is the smallest plant yet built by that company and has been named by them the "Civic Repair Plant." The guaranteed capacity of this little plant was 500 sq. yds. per day of 2 inches thick topping mixture. Advices from Dayton state that over 600 yds. per day have already been turned out of the plant, although it is yet new and the operatives are not as familiar with the work as they will be after a longer experience. The plant is a steel frame, fireproof structure containing the usual equipment of machinery of the Hetherington & Berner type. Those in charge of the work at Dayton have expressed themselves as very well pleased with the city's new venture and the results they are attaining therefrom.

Messrs. Hetherington & Berner report a very busy season just closing. In addition to the little Dayton plant they have just about finished the installation of a very fine municipal repair plant for the city of Columbus, Ohio, of over 1,000 sq. yds. per day capacity. The Columbus plant will be under the charge of Mr. W. W. Horn, the city's asphalt expert, under Mr. Maetzel, city engineer. This plant is said by the makers to be the finest, although not the largest, example of asphalt plant building that they have yet produced. No expense has been spared in its construction. The Hetherington & Berner Company have this season been very busy in the construction of their one-car railway plants. These plants have proven very successful, the Warner-Quinlin Co., having wired a duplicate order for a plant simliar to the one they bought last

season. Recent purchasers of these plants include the R. F. Conway Co., of Chicago and P. McDonnell, of Duluth, Minn.

Pioneer Filler Asphalt.

The American Asphaltum and Rubber Co., Woman's Temple, Chicago, Ill., had a comprehensive exhibit of their products at the recent convention of the American Society of Municipal Improvements and paid special attention to the presentation of their Pioneer asphalt filler for brick and block pavements, which was first used in 1896 and is therefore not an experimental material. A booklet was distributed giving endorsements from city officials in many States and showing the effect of the filler in deadening the noise from brick pavements, in permanently filling the joints and protecting the edges of the brick from wear. The permanence of the filler is one of the points most frequently noted.

Buffalo Gas Rates in Controversy.

The Buffalo Gas Company, of Buffalo, N. Y., appealed to the federal courts recently to restore the price of gas in that city to $1. The rate now in effect is 95 cents and was fixed by the gas and electricity commission. The gas company claims that the action of the commission in fixing a 95 cent rate is confiscatory and in violation of the fourteenth Amendment of the federal constitution. The city is required to show cause why an injunction should not issue restraining it from enforcing the rate fixed by the commission. The order was made returnable on October 2.

Trade Publications.

Wyckoff wood pipe is fully set forth in all its details of design and construction in a booklet issued by the Wyckoff Supply Co., Elmira, N. Y.

The Simplex Valve and Meter Co., 112 Broad St., Philadelphia, has issued the second edition of its 1907 catalog, describing water meters for large pipes, controlling valves for standpipes or reservoirs, rate controllers and loss of head gauges for filters, automatic air valves, etc. A description of the Simplex water meter will be found elsewhere in this department.

The Feltz & East Co., Lima, O., issue a circular description of their cast-iron iron culvert and sewer pipe.

Bulletin No. 16 of the Association of American Portland Cement Manufacturers, Philadelphia, Pa., is entitled "Regulation and Control of Concrete Construction."

Supply Catalog No. 20 of the Iroquois Iron Works, Buffalo, N. Y., lists and describes asphalt and roofing tools, including asphalt sandals, melting and pouring pots, curb tongs, dippers, asphalt cutters, smoothers, tampers, rakes, patching hoes, concrete and asphalt mixer, mastic and roofers' asphalt and tar kettles, surface heaters, fire wagon, self propelling concrete mixer and steam rollers.

The Traylor Engineering Co., Allentown, Pa., issues monthly postal cards containing instructions for using and caring for various pieces of apparatus and machinery.

The Conneaut Shovel Co., Conneaut, O., issues a catalog which gives a very interesting history of the development of the Mikkola or Ronberg shovel for special purposes, such as shoveling ore, coal, etc. It also lists their other spades and shovels of which they have a line of special designs for special purposes.

The most improved types of electric locomotives and mining machines are shown in Jeffrey Bulletins Nos. 10, 11 and 12, issued by The Jeffrey Mfg. Company, Columbus, Ohio, U. S. A.

Trade Notes.

BRICK.

Jasonville, Ind.—A plant will be erected here for the manufacture of paving brick from shale. Wood Noel, Jr., Terminal Bldg., Indianapolis, is interested.

Columbia, S. C.—The discovery of a fine quality of shale on the farm of F. H. Hyatt, just north of this city, will probably lead to the establishment of a large plant at an early date.

CEMENT.

Jasper, Tenn.—A party of men representing the Southern States Portland Cement Co., of Rockmart, Ga., were in this city recently looking over the land owned by S. H. Alexander and W. T. Dunwoody, which lies along the foot of the mountain at the Blue Spring, with the purpose of locating a large cement plant here.

VanDorn, Ala.—The VanDorn Portland Cement Co. has been incorporated and purchased 4,000 acres of land here on which a cement plant will be built. The officers of the company are President, J. L. Means, Shreveport, La.; treasurer, W. J. Bayersdorffer.

CONCRETE BLOCKS.

Gowrie, Ia.—The Gowrie Cement Works is to be formed by Luther Anderson, A. N. Ahlstrom, C. J. Lantz, Joseph Johnson and David Linnarson. A tile machine has been ordered and machinery for manufacturing brick block and posts will be installed.

Elkhorn, Wis.—W. C. Hopper is erecting a cement block plant here.

Valleyford, Wash.—A. C. Bunnel, of Farmington, Wash., has purchased a site here and will engage in the manufacture of concrete blocks.

Superior, Wis.—The Superior Hydraulic Stone Co. has been incorporated by W. R. Fanning, G. E. Rolph, and Henry Huseby, to carry on a general stone business.

New Albin, Ia.—I. Vickerman is to be manager of a new concrete plant here.

Minneapolis, Minn.—The partnership of Frank W. Tidball and Charles E. Brewster in the Nodamp Concrete Block Machinery Company has been dissolved, according to press reports.

Ingersoll, Ok.—The Ingersoll Cement & Rock Building Co. has been incorporated by C. A. Bodey, W. P. McAfee, J. F. Fisher and B. B. Fees.

St. Paul, Minn.—The Interstate Pressed Brick Co. has been incorporated to engage in the manufacture of cement brick and other goods, by C. H. Watson, of Waseca, Minn.; G. L. Rolfe, of Spokane, Wash.; F. T. Day, of Waseca.

Milwaukee, Wis.—Emery C. Hodges has invented a new form of building block made from pulverized stone, granite or marble, by a patented process which makes the completed article the exact appearance of the original stone.

Waverly, Ia.—E. H. Martin and J. H. Mueller, of Tripoli, Ia., are interested in the formation of a company to eslish a cement tile and concrete plant here.

Sibley, Ia.—The Northwestern Construction Co. has been formed here to do tile contracting with a preference for cement tile. L. A. Wilson will be general manager.

Groton, S. D.—The cement block and contracting business of A. J. Laidlow has been purchased by B. H. Greene, his partner.

Thornton, Ia.—Perry Bailey and Walter Thada may engage in the manufacture of cement tile.

Little Falls, Minn.—Press reports state that there is agitation here for the establishment of a cement brick plant.

West Salem, Wis.—E. F. Waga has patented a brick making machine for making cement brick.

West Duluth, Minn.—A cement brick plant is proposed here, to use Lake Superior sand. The Cement Brick Co., of Port Huron, Mich., is interested.

Des Moines, Ia.—The Enamel Concrete Brick Co., is preparing to erect a manufacturing plant to produce its brick machines.

Superior, Wis.—P. J. Ross, Harry Husby and W. R. Fanning have organized a company to engage in the manufactuore of concrete stone and building blocks. Cement bricks will also be manufactured.

Austin, Minn.—The manufacture of cement tile is contemplated by Nels Nickelson.

Spearfish, S. D.—Ben Badger may establish a concrete block and cement tile plant.

Waverly, Ia.—A cement tile plant is proposed here.

Abserokee, Mont.—A cement block plant is to be started here.

Columbus, Ga.—The Girard Concrete Co., manufacturers of concrete sewer pipe and well curbing, will engage also in the manufacture of concrete bricks and hollow blocks. D. C. Foster is president of the company.

Chicago, Ill.—The American Concrete Co. has been incorporated to manufacture concrete products by G. H. Scribner, Jr., W. C. Spaulding, and R. W. Lamson.

Elizabeth, N. J.—The Standard Concrete Stone Co., has been incorporated by Peter J. Olde, John H. Olde, and Louise F. Olde.

Waukesha, Wis.—The Diamond Concrete Stone & Construction Co. has been incorporated by Perry Sawyer, Carl H. Sawyer, and W. P. Sawyer.

PURCHASE OF MACHINERY.

Farmington, Mo.—Special. John Aiton desires to communicate with manufacturers of good machinery for producing cement pipe, building blocks etc. Address care John T. Williams.

Fort Smith, Ark.—Special. T. H. Hipple, 417 N. 10th st., is in market for 1 dozen eccentric clamps suitable to clamp together from 10 to 12 ins. in thickness.

Waynesburg, Pa.—Special. W. F. Blair & Sons are in the market for a self-feeding rip saw and 1 small turning lathe.

Sabetha, Kas.—Special. A. R. Stimson, of the Sabetha Concrete Stone Works, desires names of firms handling crushed granite or other material which is used for polished cement floors, who can give full information as to laying and finishing such floors.

Columbia, S. C.—Special. Fingal C. Black, 1410 Main st., is in market for catalogues of machinery and tools for building and caring for roads and streets.

Grabd Island, N. Y.—Special. Fremont Simonds is in the market for a concrete mixer.

Endeavor, Kas.—Special. F. L. Colburn is in the market for a second-hand hand or foot power circular saw.

Algona, Ia.—Special. William E. Bowman is in the market for a block machine and a tile machine.

Charleston, W. Va.—Special. Pfaff & Smith, street paving and sewer contr., advise us that they are in the market for a practical concrete mixer for street work.

PURCHASE OF MATERIALS.

Grand Island, N. Y.—Special. Fremont Simonds is in the market for cements.

Columbia, S. C.—Special. Fingal C. Black, 1410 Main st., advises us that he desires samples of paving brick and other paving materials.

Sabetha, Kas.—Special. A. R. Stimson, of the Sabetha Concrete Stone Works, desires names of firms handling crushed granite or other material which is used for polishing cement floors, who can give full information as to laying and finishing such floors.

LIGHT, HEAT AND POWER.

Antioch, Ill.—The Antioch Electric Co., has been organized here to sell and produce electricity, by Hiram H. Kellog, Jay R. Cribb, and John K. Cribb.

Decatur, Ill.—The Puritan Mfg. Co., has been organized here to engage in the manufacture of lighting apparatus, by Fred W. Smith, E. L. Crum, and Clarence W. Lucas.

Rockford, Ill.—The Warner Elec-

trical Engineering Co., is being organized here to manufacture and deal in electrical instruments and machinery, by Romaine LeM. Warner, Carl Spalding, and E. M. St. John.

Kansas City, Mo.—The Weber Gas Engine Co., of this city, has been incorporated in Illinois with offices in Chicago.

Hazleton, Pa.—Calvin Pardee, of Germantown, will, with his sons, establish a plant at Milnesville, 2-mis. north of here, for the manufacture of electrical supplies.

MISCELLANEOUS.

Litchfield, Ill.—The Hamm Construction Co., has been organized to engage in contracting, paving and construction, by John Hamm, Nellie Hamm and T. J. Byrne.

Maroa, Ill.—The Kansas City Numbering Co. has started a force to work in the establishment of a system of numbers for the business and residence portions of this city.

Marion, O.—The Marion Steam Shovel Co. of this city was awarded the contract for furnishing 12 steam shovels for use by the Isthmian Canal Commission in the Panama Canal for $158,160.

Camden, N. J.—The Kinzua Valley Paving Block Co., has been incorporated by Mathias A. Madison, Clarence D. Lamb, and S. E. Lewis.

Patents Concerning Sewage and Sewage Disposal.

818,875. Flushing Tank for Sewers. Reverdy C. De La Hunt, Cedar Rapids, Ia.

819,720. Screen for Sewage or the Like. Frederick Brunotte, Hamburg, Germany.

821,050. Sewage Ejector. Frederick Meyer, Chicago, Ill., and Chas. T. Hildebrandt, Dayton, O.

822,512. Flush Tank Siphon. Reverdy C. De La Hunt, Cedar Rapids, Ia.

822,562. Fastener for Manhole Covers. Francis J. Tucker, Philadelphia, Pa.

828,515. Cleaning Vat for Sewage. Bruno Schmidt, Dresden, Germany.

832,463. Means for Facilitating the Cleaning of Street Catch Basins. Wm. H. Englebrecht, New York, N. Y.

832,710. Drainage and Sewer Sanitary Appliance. Jas. J. Wade, Chicago, Ill.

834,135. Sewer Opener. David Hymes, Chicago, Ill.

835,012. Manhole Construction. David Craig, Melrose, Mass.

836,323. Process of Sewage Disposal. John W. Keegan, Santa Rosa, Cal.

836,386. Sewage Disposal Apparatus. John W. Keegan, Santa Rosa, Cal.

837,764. Sewer Pipe Truck. Frederich H. Wippler, St. Louis, Mo.

838,354. Sewer Base. Gustave Rader, Montclair, N. J.

839,396. Apparatus for Separation of Solid Matters from Sewage, etc. Christoph Kremer, Berlin, Germany.

840,179. Apparatus for Purifying Sewage. Alfred Voglesang, Dresden, Germany.

840,747. Temporary Retaining Wall for Use in the Construction of Sewers. Michael P. Burne, Chicago, Ill.

842,286. Sewage Elevating and Discharging Apparatus. Eric A. Wilson and Chas. Rigdon, Duluth, Minn.

844,341. Sewer Trap for Catch Basins. Frederick C. Few, Albany, N. Y.

844,451. Cesspool. Edward Helber, Farmington, Mo.

847,361. Automatic Flush Tank. Scott A. and Wm. H. Palmer, San Diego, Cal.

847,582. Triple Alternating Siphon. Sidney N. Miller, Chicago, Ill.

848,279. Apparatus for Sewage Disposal. Burton J. Ashley, Chicago, Ill.

848,365. Siphon. John F. Harrigan, Boston, Mass.

Patents Concerning Municipal Applications of Electricity and Gas.

791,355, 791,356. Street Lamp and Gas Burner, Ragland Momand, New York, N. Y.

792,892. System and Means for Laying Electrical Wires in Conduits. Guy M. Gest, Cincinnati, O.

798,196. Conduit for Electric Wires. Robert W. Lyle, New York, N. Y.

805,665. Conduit. Daniel E. Reagan, Terre Haute, Ind.

820,369. Street Light. Arthur E. Shaw, Philadelphia, Pa.

838,263. Metal Conduit Construction. Thos. J. Moore, Sandusky and Eliza Ball, Minden City, Mich.

840,586. Street Lamp. Fredrick Rech, Ehrenfeld, near Cologne, Germany.

851,340. Means for Bonding Electric Conductors. Harold P. Brown, Mantclair, N. J.

Patents Concerning Processes and Apparatus for Excavating.

790,910. Device for Facilitating Driving Hollow Piles or Pipes. Wm. T. McClintock, Sewickley, Pa.

794,268. Metal Sheet Piling. Henry Wittekind, Chicago, Ill.

796,703. Sheet Pile Driver. Amesa B. Clark, New York, N. Y.

796,747. Excavating Machine. Wallace Marshall, Lafayette, Ind.

797,786. Metal Sheet Piling. John R. Williams, East Orange, N. J.

799,090. Pile Driver. A. A. Raymond, Chicago, Ill.

801,946. Metallic Sheet Piling. Julius R. Wemlinger, New York, N. Y.

803,697. Wood Sheet Piling. Andrew Lanquist, Chicago, Ill.

808,870. Self - Loading Scraper. Hurschel F. Purdum, Sac City, Iowa.

810,165. Self-Dumping Scraper. John F. Mendenhall, Springville, Utah.

816,770. Sheet Piling. Henry L. Zander, New Orleans, La.

816,994. Interlocking Sheet Piling. Geo. E. Nye, Chicago, Ill.

818,596. Metal Sheet Piling. John R. Williams, East Orange, N. J.

819,063. Sand and Cavings Pump. Howard R. Hardenburg, Saginaw, Mich.

819,090. Scraper. Archie M. Smith and Wm. C. Dean, Ballinger, Tex.

820,152. Excavating and Ditching Machine. Jas. K. Sweeny, Pueblo, Colo.

820,304. Metal Piling. Jas. J. Harold, Jersey City, N. J.

821,560. Wheeled Scraper. Wm. P. Warren, Sheridan, Ill.

823,982. Sheet Piling. Guy Webster, York, Pa.

824,839. Trenching Machine. Hans J. Bentson, Chicago, Ill.

826,801. Metal Sheet Piling. Chas. H. Orumby, Jr., Pittsburg, Pa.

829,399. Sheet Piling Section. Truman Hill, Chicago, Ill.

829,596. Sheet Piling. Jacob J. Nolty, Canal Dover, O.

829,903. Machine for Handling Material for Tunnel Arch Construction. Edward G. Williams and Elmer H. Brown, Washington, D. C.

830,515, 830,516. Construction and Sinking of Caissons, etc. Daniel E. Moran, Mendham, N. J.

831,094. Ditching Machine. Oscar C. Pierce, Stockton, Cal.

831,665. Sheet Piling. Truman Hill, Chicago, Ill.

834,051. Sheet Piling. Luther P. Friestedt, Chicago, Ill.

834,086. Sheet Piling. Chas. C. Tomkinson, Plainfield, N. J.

836,725. Metal Sheet Piling. John R. Williams, East Orange, N. J.

836,792. Metal Sheet Piling. John R. Williams, East Orange, N. J.

836,832, 836,833. Metallic Sheet Piling. Ralph V. Sage, Westmont, Pa.

836,987. Interlocking Metal Sheet Piling. Geo. E. Nye, Chicago, Ill.

837,692. Metallic Piling. Freidrich W. Lang, Hamburg, Germany.

838,152. Metal Sheet Piling. John R. Williams, East Orange, N. J.

839,608. Sheet Piling. Tryggoe Larssen, Bremen, Germany.

839,954. Pile and Method of Forming the Same. Alfred A. Raymond, Chicago, Ill.

840,884. Metal Piling. Julius R. Wemlinger, Brooklyn, N. Y.

840,952. Interlocking Metal Sheet Piling. Geo. E. Nye, Chicago, Ill.

841,197. Sheet Piling. Chas. C. Tomkinson, Plainfield, N. J.

841,773. Trench Sheeting. Albert W. Fitzgerald, Terre Haute, Ind.

842,120. Piling. Frank W. Skinner, New York, N. Y.

843,307. Sheet Pile. Frank W. Skinner, New York, N. Y.

847,801. Tunneling Apparatus. Frank A. Moffitt, Chicago, Ill.

848,143, 848,144, 848,145. Metal Sheet Piling. Julius R. Wemlinger, Brooklyn, N. Y.

848,395. Pile Core. Alfred A. Raymond, Chicago, Ill.

848,742. Excavating Machine. John Helm, St. Louis, Mo.

848,743. Excavating Bucket and Cutter. John Helm, St. Louis, Mo.

849,013. Wheeled Scraper. John S. Norris, Red Lodge, Mont.

849,043. Method of and Apparatus for Sinking Wells. Eugene F. Bradt, Detroit, Mich.

850,043. Interlocking Metal Sheet Piling. Geo. E. Nye, Chicago, Ill.

850,496, 850,497. Sheet Piling. Paul A. Schuchart and G. G. Brown, New York City.

851,411. Tunnel Construction and Ventilation. Frank J. Ferrell, New York, N. Y.

851,532. Coffer-Dam and Caisson Construction. Geo. A. LeFeore, Piermont, N. Y.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Indianapolis, Ind.—A temporary injunction was refused by Judge Lawson M. Harvey superior court, room 4, October 11, to prevent the city from making an assessment against the property of Margaret Perry for benefits resulting from the improvement of Cornell ave., from 10th to 21st sts. Brick paving had been ordered for the street, which was later modified to provide for Warren's bitulithic. This action was taken over the protest of the property owners along the street, and when it was finished and accepted and assessments made against the abutting property for the cost of the improvement, a test case was made by Mrs. Perry.

CONTEMPLATED WORK.

Revere, Minn.—Permanent sidewalks are contemplated.

Fargo, N. D.—Council will be petitioned to pave 4th st.

Lincoln, Neb.—Council has created paving district No. 123.

Atlanta, Ga.—Asphalt paving is contemplated for Peachtree st.

Linden, Ia.—The construction of permanent sidewalks is proposed.

Selma, Ala.—Ordinances have been passed for paving 5 streets.

Akron, O.—The estimated cost of paving 1800 ft. of North Hill is $28,000.

Saginaw, Mich.—Council has adopted the report favoring paving for Thompson st.

Mispah, Minn.—The town of Englewood is considering the construction of roads.

Mankato, Minn.—Brick paving is contemplated for 2nd st. M. B. Haynes, cy. engr.

Cadillac, Mich.—Paving is contemplated next spring for a number of blocks of streets.

Peoria, Ill.—Ordinances are pending for paving Chestnut and S. Adams sts. with brick.

Batavia, Ill.—Macadam or brick paving is contemplated for Batavia ave. Mayor Snow.

Chicago, Ill.—Macadam or brick paving is contemplated for W. 115th st. from Wentworth to Stewart aves.

Tacoma, Wash.—Council has approved the plans of the park board for constructing a boulevard

Oyster Bay, L. I., N. Y.—Bids will be asked soon for improving 1750-ft. of Central Park road.

Mesa, Ariz.—Bids will be asked soon

for concrete curb and gutter. O. A. Turney, C. E., Phoenix.

Altoona, Pa.—The bd. of pub. wks. will let contracts soon for paving a large number of streets.

Boone, Ia.—Bids will be aksed for soon for paving 1st ave. N. with brick. K. C. Kastberg, cy. engr.

Ft. Dodge, Ia.—Bids will be asked soon for paving 1st ave., N., with brick. C. H. Reynolds, cy. engr.

Mason City, Ia.—Bids will be asked for soon for paving Central ave. with brick. J. H. McEwen, cy. clk.

Duluth, Minn.—Petitions are being circulated for paving Oneonta st., the work to be done early next spring.

Bloomington, Ill.—Vitrified brick paving has been ordered constructed in W. Jefferson st. and an alley.

Xenia, O.—Ordinances have been introduced providing for brick paving on Whiteman st. and grading a number of streets.

St. Augustine, Fla.—San Marco ave. is to be paved with vitrified brick under the supervision of street and lane committee.

Chattanooga, Tenn.—A resolution has been prepared providing for the creation of a paving district Market, W. 6th and Walnut sts.

Elgin, Ill.—Plans for 3600-sq. yds. of brick paving on N. Liberty st., with 1370-ft. of concrete curbing, have been completed. Mayor Price.

New York City.—The city comptroller has been authorized to issue $100,000 bonds for repairing, maintaining and repaving streets in the boro of Manhattan.

Ft. Wayne, Ind.—This city contemplates the construction of about 4-mis. of brick and asphalt paving and cement sidewalks. E. J. Lemon, chm. B. P. W.

Vernon, Ind.—The citizens of this town and North Vernon have petitioned the county commissioners for the construction of a boulevard connecting the two towns.

Aurora, Ill.—Iora and Pennsylvania aves. will be paved with asphalt and 2nd ave. with brick in the spring. Petitions have been filed for paving several streets.

Little Rock, Ark.—Paving is proposed for an alley between Main and Louisiana sts. from 4th to 5th. A petition is being circulated for paving W. 3d st. with brick.

Auburn, Ind.—No bids were received Oct. 14 for constructing sidewalks and paving Ensley ave. and it is probable that no action will now be taken on the proposed work until next spring.

Columbia, S. C.—Plans and specifications for paving Main st. with brick, asphalt or bitulithic, have been approved by council, and bids will be asked soon. J. L. Ludlow, Winston-Salem, engr.

Lawton, Ok.—City engr. Kennard has been instructed to prepare plans and specifications for paving a number of streets with asphalt, bitulithic, brick and macadam, and bids will be asked soon. Mayor Jones.

Port Huron, Mich.—This city contemplates paving Quay st. with brick next spring. About 4000-ft. of paving is proposed for Howard st. next sumer, also, but the material has not been decided upon. W. W. Phelps, cy. engr.

Ashtabula, O.—City council has appropriated $1900 as the city's share for the improvement of the east approach to the Spring st. viaduct by paving, grading, draining, constructing curb, gutter, catch basins, manholes, etc.

Fort Worth, Tex.—Special. J. J. Nunnally, cy. audt., advises us that this city expects to pave about 15-mis. of streets with brick, asphalt or bitulithic. Standard specifications may be had on application to E. C. Woodward, cy. engr.

Chicago, Ill.—The property owners in Madison st., from 5th ave. to the lake, want that street repaved with asphalt.

Leetonia, O.—Plans and specifications have been submitted for grading Oak st.

Fond du Lac, Wis.—Mayor T. L. Doyle is in favor of council taking action at its November meeting towards learning what material the property owners desire, preparing plans and specifications, and asking for bids during the winter for paving proposed for next year.

Wichita, Kas.—New estimates have been prepared for paving seven unpaved alleys betwen William and 1st sts.

Mankato, Minn.—Petitions of the property owners asking that Hanover st. be graded and otherwise improved are under consideration.

Buffalo, N. Y.—Special. Common council contemplates paving Ludington st. from Ideal to Bensinger sts. with California asphalt. Purdy st. from Laurel to Utica, has been ordered paved with the German Rock Co.'s asphalt.

CONTRACTS TO BE LET.

Millvale, Pa.—Bids are asked until Nov. 5 for paving and setting curb. Boro clk.

Fond du Lac, Wis.—Bids are asked until Nov. 4 for granitoid alley paving. B. P. W.

Ft. Wayne, Ind.—Bids are asked until Nov. 7 for grading Short st. H. W. Becker, cy. clk.

Lakewood, O.—Bids are asked until Nov. 4 for paving Newman ave. B. M. Cook, vil. clk.

Red Bank, N. J.—Sealed bids are asked until Nov. 4 for paving Front st. A. C. Harrison, clk.

Little Falls, Minn.—Bids are asked until Nov. 4 and 7 for state road work. Ole Wahl, co. comr.

Richwood, O.—Bids are asked until Nov. 9 for improving Franklin ave. R. L. Jordan, vil. clk.

Davenport, Ia.—Bids are asked until Nov. 15 for paving several streets. Thomas Murray, cy. engr.

Youngstown, O.—Bids are asked until Nov. 7 for paving Wick and Summit aves. W. H. McMillin, clk. B. P. S.

Logansport, Ind.—Bids are asked until Nov. 29 for constructing a gravel road. George W. Cann, Co. audt.

Monticello, Ind.—Bids are asked until Dec. 3 for constructing a gravel road. J. L. Ackerman, co. audt.

Brookhaven, Miss.—Bids are asked until Nov. 18 for constructing about 5-mis. of concrete sidewalks. Cy. clk.

Seattle, Wash.—Bids are asked until Nov. 2 for constructing concrete sidewalks on various streets. B. P. F.

Salem, Ind.—Bids are asked until Nov. 4 for constructing 20 1-4-mis. of gravel roads. Sam G. Ellis, co. audt.

Olympia, Wash.—Bids are asked until Nov 9 for grading a state road. Jos. M. Snow, secy. state highway com.

Monclova, O.—Bids are asked until Nov. 2 for macadamizing 1-2-mi. of

county road. John C. Whitehead, twp. clk.

Jasper, Ind.—Bids are asked until Nov. 4 for 4235-ft. of stone paving in Patoka twp. M. A. Sweeney, co. audt.

Cleveland, O.—Bids are asked until Nov. 6 for completing the Miles ave. improvement. A. B. Lea, co engr.

Stoddard, Wis.—Bids are asked until Nov. 5 for furnishing 100 cords of quarried limestone rock. Edward Wolf, vil. clk.

Decatur, Ind.—Bids are asked until Nov. 4 for macadamizing roads in Root and Kirklin twps. C. D. Lewton, co. audt.

North Braddock, Pa.—Bids are asked until 3 p. m. Nov. 1 for paving Cliff st. with brick. C. A. Stewart, boro engr.

Sandusky, O.—Bids are asked until Nov. 18 for improving Venice road by placing stone on it. Chas. Kubach, co. audt.

Brookville, Ind.—Bids are asked until Nov. 5 for constructing 4000-ft. of gravel roads. Chas. A. Miller, co. audt.

Kokomo, Ind.—Sealed bids are asked until Nov. 6 for constructing a large amount of gravel roads. Wm. L. Benson, co. audt.

Crawfordsville, Ind.—Sealed bids are asked until Nov. 5 for improving a highway in Union twp. Benjamin F. Carman, co. audt.

Sullivan, Ind.—Bids are asked until Nov. 4 for constructing 9090-ft. of stone road in Hamilton twp. E. E. Russel, co. audt.

Cincinnati, O.—Sealed bids are asked until Nov. 15 (readv.) for improving Hog Back road. Stanley Struble, prest. co. comrs.

Ft. Wright, Wash.—Sealed bids are asked until Nov. 6 for installing concrete curbing for roads. B. T. Scher, constr. Q. M.

Vincennes, Ind.—Bids are asked until Nov. 5 for constructing 104,602-ft. of gravel roads in Decker twp. John T. Scott, co. audt.

Davenport, Ia.—Sealed bids are asked until Nov. 5 for paving 2 alleys with brick on concrete base. Thomas Murray, cy. engr.

Denton, Md.—Bids are asked until Nov. 12 for macadamizing about 1-mi. of Denton Three Bridges road. S. D. Lukes, clk. co. comrs.

Peru, Ind.—Bids are asked until Nov. 4 for constructing 23 1-2-mis. of gravel roads in Richland twp. Charles Griswold, co. audt.

Redding, Cal.—Bids are asked until 10 a. m. Nov. 7, for clearing and building 204-mis. of wagon road. S. N. Witherow, vlk. bd. supvrs.

Ft. Wayne, Ind.—Bids are asked until Nov. 2 for constructing 9563-ft. of macadamized roads in Madison twp. George W. Lindemuth, co audt.

Wilmington, Del.—Sealed bids are asked until Nov. 5 for constructing a macadam road. Francis A. Price, state highway comr., New Castle co.

Rockville, Ind.—Sealed bids are asked until Nov. 7 for constructing a gravel road in Florida twp. T. A. Garrard, chrn. co. comrs.; H. A. Henderson, co. audt.

Janesville, Wis.—Bids are asked until Nov. 9 for constructing cement gutters and combined curb and gutter on Chatham st. S. B. Heddles, chm. st. ass'mt. com.

Brooklyn, N. Y.—Bids are asked until Nov. 6 for repaving a number of streets with asphalt, wood block and asphalt blocks. Bird S. Coler, prest. boro.

Columbus, Ind.—Sealed bids are asked until Nov. 4 for constructing 4761-ft. of gravel roads in Columbus twp. W. O. Clark, chmn. co. comrs.; John M. Davis, co. audt.

Paoli, Ind.—Sealed bids are asked until Nov. 5 for constructing 1438-ft. of macadamized road in French Lick twp. Geo. R. Cadle, chmn. co. comrs.; Alvin B. Ham, co. audt.

Hobart, Ind.—Sealed bids are asked uutil Nov. 9 for 41,700-sq. yds. of brick, bitulithic or asphalt paving; 8600-lin. ft. stone or concrete curbing; 4000-lin. ft. headers. A. W. Kerr, cy. clk.

Greencastle, Ind.—Sealed bids are asked until Nov. 2 for constructing 16,340-ft. of gravel roads in Russell twp. and 10,556-ft. in Monroe twp. V. B. McCammack, chmn. co. comrs.; C. C. Hurst, co. audt.

Pensacola, Fla.—Bids are asked until Nov. 15 for 170,700-sq. yds. of clay or shale block, sheet asphalt, bitulithic, wood block or macadam paving and 115,950-lin. ft. concrete curbing. L. Hilton Green, chmn. bd. bond trustees.

Salt Lake City, Utah.—Sealed bids are asked until Dec. 6 for paving 1st South st. as follows: grading, 60,000-cu. yds.; curbing, 17,000-lin. ft.; asphalt paving, 41,000-sq. yds. F. J. Leonard, chmn. B. P. W.; Louis C. Kelsey, cy. engr.

Troy, O.—Bids are asked until Nov. 12 for constructing 2,800 lin. ft. of macadam road; substructure of bridge and reinforced concrete culvert. The work includes the following: 5,000 cu. yds. earth excavation, 28,000 cu. yds. rock excavation, 1,070 cu. yds. masonry, 160 cu. yds. reinforced concrete, 3,373 sq. yds. macadam, 360 lin. ft. of piling. H. J. Walker, co. engr.

CONTRACTS AWARDED.

Arthur, Ill.—Wm. Lough, of Arcola, was awarded a street paving contract here for $27,742.

Olympia, Wash.—The contract for grading state aid road No. 2 was awarded to C. H. Lansing, for $9750.

Leipsic, O.—The contract for paving Easton st. was awarded to Enck & Stone, of this city, for $15,679.57.

Mount Morris, N. Y.—The contract for macadamizing Main st. was awarded to McCarthy & Simerson, for $3625.

Zanesville, O.—The contract for paving Wayne ave. with brick was awarded to Adams Bros., for $8,684.08.

Davenport, Ia.—The contract for continuing the paving on 2nd st. was awarded the McCarthy Improvement Co.

Zanesville, O.—The contract for paving State st. with brick was awarded to Petit & Abele at $1.03 a sq. yd.

Fond du Lac, Wis.—The contract for paving an alley was awarded to the McCuge Construction Co., at $2.80 a sq. yd.

Casey, Ill.—The contract for street paving was awarded to the Meredith Construction Co., of Terre Haute, Ind.

Zanesville, O.—The contract for paving State st. with brick was awarded to Petit & Abele, at $1.02 a sq. yd.

Montesano, Wash.—The contract for constructing the South Side Cotuny road was awarded to A. H. Moulton, for $12,000.

Chehalis, Wash.—The contract for macadamizing Prindle st. was awarded to Anderson & Robinson, of this city, for $8948.

Ft. Wayne, Ind.—The contract for constructing 6020-ft. of macadam road was awarded to Wm. Busching for $4393.

St. Paul, Minn.—The contract for grading, macadamizing, gutters, etc., in Valley st. was awarded to Keough Bros., for $4500.

Jersey City, N. J.—The contract for paving Baldwin ave. with asphalt was awarded to the Barber Asphalt Co. for $7000.

Hanska, Minn.—The contract for conconstructing cement crossings was awarded to John Gronauer, of New at $1.80 a sq. yd.

Decatur, Ill.—The contract for paving W. William st. with brick on concrete was awarded to S. A. Tuttle & Co., for $3291.10.

Champaign, Ill.—The contract for paving Elm st., with brick was awarded, Oct. 16, to J. W. Stipes, of this city, for $5334.20.

Ft. Wayne, Ind.—The Moellering Construction Co. was awarded the contract for paving Winter st. with brick, at $7.06 a lin. ft.

Mendota, Ill.—The contract for paving Washington st. and 13th ave. was awarded to Keyes & McNamara, of La Salle, for $22,507.50.

Eugene, Ore.—The contract for paving Willamette st. with bitulithic was awarded to the Warren Construction Co., at $2.50 a sq. yd.

Waynesburg, Pa.—The contract for paving E. High st. with brick was awarded to the Hallam Construction Co., at $1.79 to $1.80 a sq. yd.

Salt Lake City, Utah.—P. J. Moran was awarded the contract for paving N. State and 1st North sts. and Hillside ave. for $53,248.60.

Milwaukee, Wis.—The Barber Asphalt Paving Co., was awarded the contract, Oct. 11 for paving National ave. with asphalt at $2.35 a sq. yd.

Beardstown, Ill.—Contracts for street paving aggregating $79,805.12 were awarded to F. J. Traut and T. J. Schweer, of this city, Oct. 15.

Pittsburg, Pa.—M. O'Herron & Co. secured the contract for paving Webster and 6th aves., Oct. 15, at $17,606 and $18,430 respectively.

Chickasha, I. T.—The contract for paving Kansas ave. was awarded to the Cleveland Trinidad Paving Co., of Cleveland, O., at $1.50 a sq. yd.

Chicago, Ill.—The Schuman Paving Co., has been awarded the contract for paving the west side of Dearborn st. with blocks treated with asphalt.

Zanesville, O.—Adams Bros. secured the contract, Oct. 19, for paving Ridge ave. for $13,723.30.

Greenwich, O.—The contract for paving in this city was awarded to the Bluffton Stone Co., of Bluffton, O., for $12,077.86.

Buffalo, N. Y.—Special. The following low bids for paving were reported to the common council, Oct. 14: Mary st. between Indiana and Illinois, 1043-sq. yds. on macadam base, F. V. Bardol, 400 D. S. Morgan Bldg., Buffalo, $3500; dressed block Medina sandstone, $4900; asphalt, H. P. Burgard, 418 Prudential Bldg., $3100; Mississippi st., between Elk and Perry, 3905-sq. yds.—H. P. Burgard, Medina sandstone, $14,200 or asphalt, $11,000. Barthol st., between Genesee and Urban, 2254-sq. yds.—F. V. Barthol, brick, $7800; Barber Asphalt Paving Co., asphalt, $7154. Zittle st. from Seneca to Wells st., 4978-sq. yds.—F. V. Bartol, brick, $16,900; German Rock Asphalt Co., asphalt, $19,400.

Carterville, Mo.—The contract for constructing 30,000-lin. ft. of cement sidewalks was awarded Oct. 17, to Gray, Bauer & Co., of this city.

Milwaukee, Wis.—The contract for resurfacing E. Water st. with asphalt was awarded to the Barber Asphalt Paving Co., Oct. 5, at $2.09 a sq. yd.

Portsmouth, O.—Paving contracts have been awarded as follows: Prospect st., brick, Monroe & Son, $2160.40; Lincoln st., brick, Kelley Bros., $11,764.60.

Seattle, Wash.—The contract for paving the entrance to the fire house on Queen Anne hill with Hassam was awarded to the Bell Scott Co., Oct. 17, for $850.

Cleveland, O.—The county commissioners re-let, Oct. 5, the contract for paving 4000-ft. of Miles ave. outside the city limits, to Thomæs B. Husband, for $18,000.

Springfield, Ill.—The contract for paving Walnut st. with brick was awarded to John E. Bretz at $1.58 a sq. yd. for brick paving and 55 cts. a ft. for curbing.

Gadsden, Ala.—The contract for 20,000-sq. yds. of cement sidewalks and 30,000-lin. ft. of combined curb and gutter was awarded to Leslie M. Lockwood, of Bessemer.

Salt Lake City, Utah—The contract for sidewalk extension No. 131 was awarded to A. Campbell, at 17 cts. a sq. ft. for cement sidewalks and 12 cts. a cu. yd. for grading.

Bluffton, Ind.—Contracts for constructing stone roads were awarded as follows: Glass road, A. P. Addington, $6,844; Hesher road, Ora Garrett, of Liberty Center, $4751.

Caldwell, Idaho—The contract for constructing 20,000-ft. of sidewalk in the old townsite district was awarded to Ward & Billinger, at 75 cts. a ft. and 45 cts. a ft. for curbing.

Pomona, Cal.—The contract for paving 3rd and Thomas sts, and some of the main alleys in the business district was awarded to Lon Fleming, of this city, at about 21 cts. a sq. ft. or $20,000.

Danbury, Conn.—The contract for constructing 2123-ft. of macadam road and 550-ft. of telford road was awarded to O. T. Benedict, of Pittsfield, Mass., at $2 and $2.50 a lin. ft. respectively.

Marion, O.—Paving contracts were awarded Oct. 15, as follows: McWilliams Court, brick, Hofstetter & Dawson, $1448.10; Mill st., brick, Uncapher & Scott, $3307.30; alley, brick, A. J. Brady, $1347.30.

Newark, N. J.—The contract for grading, curbing and paving the sidewalks in Wallace and Hockel sts., Silver Lake, Belleville, twp., was awarded to John Dority & Son, for $2111.77 and for Hockel st. to Jonesone Bros., for $1273.

Boston, Mass.—Jones & Meehan secured the contract for paving Northern ave. and Sleeper st. as follows: 785-ft. edge stone, $1.05 a ft.; 6500-sq. yds. of granite blocks, $2 a sq. yd.; 670-yds. brick sidewalk, $1 a sq. yd.; 50 yds. flagging, $4.40 a yd.

Wheeling, W. Va.—George W. Lemons was awarded the contract for paving in various parts of this city at 55 cts. a cu. yd. for excavating; $1.15 a cu. yd. for gravel filling; 5 cts. a sq. yd. for sanding; 20 cts. a sq. yd. for laying brick.

Hartford, Conn.—The Southern New England Paving Co., secured the contract, Oct. 8, for repaving Asylum st. with asphalt, as follows: Constructing pavement and keeping in repair for 5-yrs., $2.08 a sq. yd.; 10 yrs., $2.28; laying extra concrete, $6.90 a cu. yd.

Los Angeles, Cal.—Contracts were awarded Sept. 30 for paving as follows: Vermont ave., Fairchild-Gilmore-Wilton Co.; Winston st., Western Paving Co.; Fremont ave., Barber Asphalt Paving Co.; Jefferson st., Western Paving Co.; E. Edgeware road, C. R. Eves; improving Echo Park ave., F. W. Whittier; Kane st., A. H. Calkins & Co.; Savanah st., Hampton Hutton; Barbee st., D. D. Chapman.

St. Louis, Mo.—Contracts for more than 5-mis. of vitrified brick and granite block paving were awarded Oct. 11, as follows: Virginia ave., brick, G. Eyermann & Bro., $5441.04; Carter ave., brick, J. E. Perkinson, $37,986.13; Euclid ave., brick, Fruin & Colnon, $87,329.50; Ivory ave., brick, Fruin & Colnon, $23,462.85; Hamilton st., Skrainka Construtcion Co., $5773.56; Broadway and Pelham sts., granite, G. Eyermann & Bros., $18,890.15; two other sections of Broadway, granite, Schneider Granite Co., $39,372.50 and $43,190.78 respectively.

New York City—Contracts for highway improvements in Long Island City were awarded by Joseph Bermel, Sept. 30, as follows: regulating, grading and repairing with macadam Green Point ave., Joseph A. Boyce, 17,940; for regulating, grading, curbing and laying sidewalks and crosswalks on William street, Long Island City, from Payntar avenue to Wilbur avenue, Joseph A. Boyce, $2,556.60; Jamaica avenue from Thirteenth avenue to Old Bowery Bay Road, Long Island City, Henry J. Mullen, $19,884.26; Elm street, Long Island City, from Academy street to Second avenue, Thomas A. Brown, $2,662.40; Twelfth avenue from Broadway to Graham ave., W. E. Lowe, $4,143; Clarke street from Main street to Van Alst ave., Long Island City, Dennis McCarthy, $5,292.06.

SEWERS.

Newport, Ky.—The court of appeals, at Frankfort, rendered a decision, Sept. 25, in the case of Albert Silva vs. the City of Newport, affirming the decision of the lower court. The object of the suit was to enjoin this city from building sewers under a special act of the legislature of 1890. The higher court holds that the city may complete the original sewer system under the act, and it lies with the city council when the work shall be done, but the city has no power to extend the system beyond the original plans as contemplated by the special act.

CONTEMPLATED WORK.

Webb City, Mo.—A storm sewer is advocated.

Rye, N. Y.—Plans will soon be ready for sewers.

Madison, N Y.—Voted to install a sewerage system.

Wellington, Kas.—Surveys for a sewer system have been made.

Collins, Miss.—A sewer system for the county jail is urged.

Fremont, O.—Plans for a sewer in Hickory st., will be prepared.

Huron, S. D.—Plans have been completed for a new sewer system.

Forsyth, Ga.—Voted Oct. 15 to issue bonds for a sewerage system.

Ann Arbor, Mich.—Sewers are proposed on Fuller and Catherine sts.

Scalp Level, Pa.—A sewer at a cost of $2500 is contemplated.

Harvard, Ill.—The construction of a sewerage system is contemplated.

Brodhead, Wis.—The question of a sewerage system is being considered.

Madison, Ga.—Voted to issue bonds for constructing a sewerage system.

Syracuse, N. Y.—Ordinances have been passed for building sewers in 4 streets.

Chambersburg, Pa.—Will vote in Nov. on the issue of bonds for a sewerage system.

Richmond, Mo.—Will vote Nov. 5 on the question of establishing a sewerage system.

Enid, Ok.—Voted to issue bonds for the construction of a storm sewer and septic tank.

Iowa City, Ia.—A hearing will be held Nov. 1 on the proposed constuction of a sewer.

Howell, Mich.—Will vote again on the issue of bonds for constructing a sewerage system.

Pauls Valley, I. T.—Voted to issue $45,000 bonds for constructing sewers and water-works.

Holly, Colo.—Plans are being considered by the town board for constructing a sewerage system.

Lafayette, Ind.—Resolutions have been adopted for constructing sewers on a number of streets.

Sea Cliff, L. I., N. Y.—A sewage disposal plant is proposed. G. Griffith Clapham, vil. clk.

Covington, Ga.—Voted to issue bonds for constructing complete sewerage and water-works systems.

Morenci, Mich.—Will vote in November on the question of constructing sewerage and water-works systems.

Bloomington, Ind.—The question of constructing a sewerage system is again being agitated by the local press.

Freeport, Ill.—Bids will be asked about Feb. 1 for building 15 to 20-mis. of sewers. G. W. Graham, cy. engr.

Dallas, Tex.—The bids submitted for constructing storm and sanitary sewers will be rejected and new bids asked.

Collindale, Pa.—Council is considering the question of constructing a sewerage system and incinerating plant.

Steubenville, O.—An ordinance has been passed for building a sewer in 3rd st. Wm. M. Trainer, coun. clk.

Adrian, Mich.—The Riggs & Sherman Co., of Toledo, O., has been directed to resume work on the storm water sewer.

Marquette, Mich.—Action on the question of installing a sewer system on N. 3rd and other streets has again been deferred.

Oxford, O.—A petition is being circulated asking that the question of constructing a sewerage system be voted on during November.

Binghamton, N. Y.—The question of reconstructing the trunk sewers in this city will probably be taken up by the new council in January.

Stroudsburg, Pa.—Special. W. E. Van Vlist, chmn. sewer & st. com., says this borough contemplates building a sewer, and he desires to secure data on the matter.

Madera, Cal.—Special. F. E. Smith, town engineer, says a resolution has

been passed to build a sewerage and water-works system, at a probable cost of $60,000.

Canton, Ill.—Mayor Hanlon has appointed a committee composed of aldermen Keyser and Johnson and engineer Chandler to devise plans for a more adequate sewer system.

Quincy, Ill.—The ordinance for constructing the North End sewer system will be ready for adoption in January and the contract will probably be let next April. Mayor Best.

Indianapolis, Ind.—Plans are being prepared for the construction of 4-mis. of local sewers to drain several sections of North Indianapolis and a large part of the city east of that section.

Hamilton, O.—Plans are being made for converting Crawfords Run creek into a 12-ft. enclosed concrete sewer and open ditch, and bids will be asked after Nov. 1. L. A. Dillon, cy. engr.

West Allis, Wis.—A division of this city by a watershed which runs southwest and northeast makes it necessary for this city to have 2 sewage disposal plants, and the city is now considering offers to furnish sites.

CONTRACTS TO BE LET.

Millvale, Pa.—Bids are asked until Nov. 5 for constructing a sewer. Boro clk.

Wapello, Ia.—Bids are asked until Dec. 19 (readv.) for building a sewer in Van Buren st.

Parkersburg, Ia.—Bids are asked until Nov. 3 for constructing 1000-ft. of sewer. W. T. Evans, town clk.

Seattle, Wash.—Bids are asked until Nov. 2 for building a sewer in 11th ave. W. C. B. Bagley, sect. B. P. W.

Sheboygan, Wis.—Bids are asked until Nov. 4 for making sewer, water and gas connections in Niagara ave. B. P. W.

Ft. Dodge, Ia.—Sealed bids are asked until Nov. 11 for constructing a sewer in 17th st. C. H. Reynolds, cy. engr.

Monroe, Wis.—Bids are asked until Nov. 5 for constructing a 5-in. sewer in E. Washington st. M. T. Gettings, cy. clk.

Trenton, N. J.—Sealed bids are asked until Nov. 5 for constructing a sewer on Hamilton ave. Harry B. Salter, cy. clk.

Girard, O.—Sealed bids are asked until Nov. 5 for constructing 5600-ft. of 18-in. pipe sewer. E. L. Hauser, vil. clk.

Marinette, Wis.—Bids are asked until 2 p. m. Nov. 2 for constructing a sewer in Josephine st. and in an alley. B. P. W.

San Jose, Cal.—Bids are asked until Nov. 5 for constructing 9932-ft. of 24x36-in. concrete sewers. Chas. H. Pieper, cy. engr.

St. Paul, Minn.—Sealed bids are asked until Nov. 4 for constructing sewers in 3 streets. John C. Grode, prest. B. P. W.

Ottumwa, Ia.—Sealed bids are asked until Nov. 4 for constructing sewers in certain streets and alleys. S. H. Mather, chmn. st. com.

Webster Groves, Mo.—Sealed bids are asked until Nov. 4 for constructing sewers in districts Nos. 1, 2, 3 and 4. Edw. S. Hart, mayor.

Cadillac, Mich.—Bids are asked until Dec. 2 for building a sewage purification works and pumping station. Geo. Johnson, clk. B. P. W.

Des Moines, Ia.—Bids are asked until Nov. 9 for constructing a reinforced concrete culvert at 30th and North sts. W. W. Wise, chmn. B. P. W.

Aurora, Ill.—Sealed bids are asked until Nov. 11 (readv.) for constructing a district sewer in sewer dist. No. 1, of 6-in. to 24-in. pipe, total estimate about $12,500. Frank D. Johnson, cy. clk.

Youngstown, O.—Bids are asked until Nov. 7 for constructing sewers in Truesdale, Perry and E. Federal sts. W. H. McMillin, clk. B. P. S.

Ft. Wayne, Ind.—Sealed bids are asked until Nov. 7 for constructing a vitrified clay pipe sewer in an alley. Edw. J. Lennon, chmn. B. P. W.

Luverne, Minn.—Bids are asked until Nov. 5 for constructing sewers in Cedar, Dodge, McKenzie, Van Eps and Spring sts. E. C. Schwartz, cy. recdr.

White Plains, N. Y.—Sealed bids are asked until Nov. 7, for constructing a trunk sewer and tunnel. Frank N. Glover, secy. Bronx Valley sewer comn.

Pensacola, Fla.—Bids are asked until Nov. 11 for constructing sewerage and plumbing at Santa Rosa Quarantine Station. Jas. Knox Taylor, Wash., D. C.

Manila, P. I.—Sealed bids are asked until Jan. 19 for furnishing and installing electrically driven pumps and motors for the new sewer system in this city. J. F. Case, ch. engr.

Chagrin Falls, O.—Sealed bids are asked until Nov. 9 for constructing a sewage purification plant, including septic tank, contact filters, sand filters, automatic controlling device. H. D. Bishop, vil. clk.

Hattiesburg, Miss.—Sealed bids are asked until Nov. 7 for constructing 2640-ft. 15, 2090-ft. 12, 8550-ft. 10 and 15, 150-ft. 8-in. sewer; 90 manholes; 7 flush tanks; 20-cu. yds. concrete masonry; 900-cu. yds. excavation; etc. J. H. Putnam, cy. engr.

Boston, Mass.—Bids are asked until Nov. 15 for constructing in earth and rock trench and tunnel, section 81 and parts of sections 83 and 85 of the extension of the high level sewer, South Metropolitan system in Brookline and Brighton. Wm. M. Brown, ch. engr. Met. water & sewerage bd.

Hobart, Ok.—Bids are asked until Nov. 9 for constructing a complete storm water sewer system, to consist of 48 to 30-in. concrete and brick sewers, 21-in. and 18-in. concrete, brick or pipe sewers, and 15, 12 and 10-in. pipe sewers, 16 manholes and 34 catch basins. O. E. Noble, cy. engr.

Auburn, N. Y.—Sealed bids are asked until 8 p. m. Dec. 8 for constructing sewers and appurtenances and sewage disposal works. The sewers will consist of 14,700-ft. of 8-in., 11,300-ft. 10-in., 6000-ft. 12-in., 3600-ft. 15-in., 300-ft. 18-in. and 1250-ft. of 20-in. sewers. The excavation varies from 5 to 18-ft. About 17,000-ft. of 5-in. vitrified tile for house connections will be laid from the main sewer to the curb line. In the main trench and underneath the main sewer sub-soil drains will be laid, as ground water demands, as follows: 20,000-ft. 4-in. 6000-ft. 6-in. 7000-ft. 8-in. 200-ft. 10-in. and 200-ft. 12-in. tile to be known as seconds. There will also be 84 manholes with an average depth of 9-ft.; 12 flushtanks; 12 manholes. The disposal works will consist of reinforced concrete septic tanks and contact beds, and automatic appliances for closing them. J. S. Hanlon, cy. clk.

CONTRACTS AWARDED.

Cincinnati, O.—Thomas P. Strack was awarded the contract for a sewer in McLean ave. for $12,300.

St. Paul, Minn.—The contract for constructing a sewer in Goff ave. was awarded to O'Neil & Preston, for $5357.

St. Paul, Minn.—The contract for constructing a sewer in Franklin ave. was awarded to Nicholas Feyen, for $4442.

St. Paul, Minn.—The contract for constructing a sewer in Sturgis st. was awarded to Ryan & Johnson, for $4170.

Miamisburg, O.—The contract for building a storm sewer in Linden and Central aves. was awarded to Wm. A. Hilt, for $6507.70.

Columbus, O.—The contract for constructing the East Side sewage pumping station was awarded to D. W. McGrath, for $18,373.

Steubenville, O.—The contract for constructing a sewer in Clinton st., was awarded to James Ferry & Son, for $8907.

Linton, Ind.—The contract for constructing a sanitary sewer was awarded to Stenhard & Morgan, for $64,000.

Elizabeth, N. J.—The contract for building a sewer in Jacquest st. was awarded to J. J. Potts, Oct. 15, for $8580.

Omaha, Neb.—The contract for constructing a sewer in Izard st. was awarded to James Jenson, Oct. 14, for $123,000.

Ensley, Ala.—The contract for completing sewers in this city was awarded to C. M. Burkhalter & Co., of Birmingham, for $5500.

Milford, Mass.—The contract for constructing a low level sewer was awarded to Bruno, Salomone & Petittl, of Boston, for $16,155.

Billings, Mont.—The contract for constructing a large sewer in North Billings was awarded, Oct. 6, to Nick Hughes, for $83,837.40.

Stillwater, Minn.—The contract for constructing a new sewerage system at the prison was awarded to W. C. Fraser, Oct. 16, for $14,000.

Norwalk, O.—The contract for constructing storm water and sanitary sewers was awarded to Penny & Corron, of Lorain, for $24,285.39.

Duluth, Minn.—A contract for constructing a sewer in Cedar ave. and Belknap st. was awarded to Anderson & Johnson, Oct. 10, for $6356.36.

Rochester, N. Y.—The contract for constructing a new system of sewers in the 21st ward was awarded to H. N. Cowles, Oct. 9, for $85,430.

Los Angeles, Cal.—The contract for constructing a sewer in Denbar st. was awarded to A. P. Pusich, for $41,700, and for a sewer in Leoli ave. to B. M. Sherer, for $42,830.

Flint, Mich.—Sewer contracts have been awarded as follows: Paterson st., A. P. Southworth, $2143.34; Stockton st., Jas. Wilson, $404.85; E. 5th st., Thos. Bergin, $916.20.

Chambersburg, Pa.—The contract for constructing a system of sewers at the Pennsylvania South Mountain sanatorium, near Mont Alto, was awarded to C. F. Hessenberger, of Harrisburg, for $11,006.16.

Oneida, N. Y.—The contract for constructing sewers in Lake and Elm sts. was awarded to Corneville Bros., Oct. 15, for $1164.42. D. J. Conroy secured the contract for a sewer in Maple st. for $418.80.

Oakland, Cal.—The contract for constructing sewers has been awarded as follows: 19th st. for furnishing and laying 8-in. pipe, $1 per lin. ft.; for furnishing and laying "Y" branches, $1 each extra; for constructing brick manholes with covers, complete, $63 each; also for the construction of the Cameron st. sewer at the following prices: for laying 8-in. pipe, 98 cts. per lin. ft.; for furnishing and laying "Y" branches, no charge; for constructing brick manholes with cover, complete, nothing; also for the construction of the Duncan st. sewer at the following prices: for furnishing and laying 8-in. pipe, $1 per lin. ft.; for laying 8-in.x6-in. pipe, 90 cts. per lin. ft.; for constructing brick manholes with covers, complete, $60 each; lamp-holes, $12; also for the construction of the Shafter ave. sewer at the following prices: for furnishing and laying 8-in. pipe $1.08 per lin. ft.; for furnishing and laying "Y" branches 40 cts. each extra. Louis Lime secured the contract for a sewer in 13th ave. as follows: for furnishing and laying 8-in. pipe, $1.15 per lin. ft.; for furnishing and laying "Y" branches, $1 each extra; for constructing brick manholes with covers, complete, $68 each.

WATER WORKS.

Palestine, Tex.—Thomas Cronin has purchased the plant of the Palestine Water-Works Co., for $45,000.

Anna, Ill.—The Anna Waterworks Co., has been incorporated to construct and operate a water-works system, by George Saford, H. P. Tuthill and J. N. Dickinson.

Racine, Wis.—A reduction in the price demanded for the local water system was made Oct. 9 by the American Water-works & Guaranty Co. The amount now asked is $1,064,509.

CONTEMPLATED WORK.

Enid, Ok.—Voted to construct waterworks.

Belle Plaine, Minn.—Voted to construct water-works.

Springfield, O.—The water mains are to be extended.

Blackshear, Ga.—A water-works system is contemplated.

Rutherford, N. J.—A municipal water plant may be established.

Nixon, Tex.—A water-works system for this place is almost assured.

Madison, Ga.—Voted to issue bonds for constructing a water-works system.

Bowbells, N. D.—Voted to issue bonds for constructing water-works.

Churdan, Ia.—Voted to issue $10,000 bonds for constructing water-works.

Wolcott, Ind.—Voted to issue bonds for constructing a water-works system.

Wood River, Neb.—Voted to issue bonds for constructing a water-works system.

Verona, N. J.—Will vote on the question of a water supply for this borough Nov. 14.

Fargo, N. D.—A resolution has been introduced providing for a better water supply.

Bristol, Tenn.—The water main is to be extended to a new source of water supply.

Aberdeen, Wash.—Will vote on the issue of bonds for bringing water from Ynochee river.

Teague, Tex.—The business men are taking action towards securing a water-works system.

Omaha, Neb.—A proposition for a municipal water plant may be submitted to vote this fall.

Wahoo, Neb.—City council is considering the question of constructing a water-works system.

Fordyce, Ark.—A petition has been circulated asking for the construction of a water-works system.

Lebanon, Tenn.—Will vote Nov. 21 on the issue of bonds for providing an adequate supply for this city.

Grand Junction, Colo.—Will vote Nov. 2 on the issue of additional bonds for a mountain water supply.

Lombard, Ill.—Preliminary plans for a water-works system have been made. S. N. Lombard, prest. vil. bd.

Raymond, Wash.—Estimates of the cost of a municipal water-works system are being made. John D. Henry, cy. engr.

Kearney, Neb.—Plans and specifications for the proposed water-works system have been filed. Cy. engr. Edwards.

Newton, Kas.—The Santa Fe Ry. Co. is to sink a number of test wells with a view of establishing its own water system.

Batavia, N. Y.—The pure water commission is preparing to make a test of the Dorman Springs for a water supply.

Winnetka, Ill.—A new water-works plant is proposed, the present equipment being inadequate for the needs of this city.

Sauk Rapids, Minn.—Plans and specifications for a new water-works system will be made and the contract let about Nov. 15.

McGraw, N. Y.—The bd. of water comrs. has decided instead of a gravity water works system to install a pumping station and sink wells.

Madera, Cal.—Special.—F. E. Smith, town engineer, advises us that a resolution of intention has been passed to build a water-works and sewer system.

Ft. Wayne, Ind.—Edward Lennon, chmn. B. P. W., believes that at least $20,000 should be expended by the city water-works department during the next year on water mains extensions.

El Dorado, Ark.—The property owners have organized an improvement district including all of the territory within half a mile of the county court house, for the purpose of establishing a water-works system.

CONTRACTS TO BE LET.

Thermopolis, Wyo.—Bids are asked until Nov. 18 for constructing a water-works system.

Shelby, Idaho.—Bids are asked until Dec. 1 for constructing water-works. N. N. Holm, engr.

Ellendale, N. D.—Bids are asked until Nov. 4 for sinking an artesian well. Edw. N. Leiby, mayor.

Oswego, Ill.—Bids are asked until Nov. 4 for water main, valve and box, hydrants, etc. Vil. bd. trustees.

Fargo, N. D.—Bids are asked until Nov. 4 for constructing a water main on 11th st. N. C. Morgan, cy. audt.

Volva, N. D.—Bids are asked until Nov. 12 for constructing a complete water-works system. G. N. Lidvahl, mayor.

Tucson, Ariz.—Bids are asked until Nov. 4 for construction a water-works system. Frank S. Treat, cy. recdr.

Phoenix, Ariz.—Sealed bids are asked until Dec. 1 for furnishing and laying water pipe. Robt. Craig, supt.

Millen, Ga.—Bids are asked until Dec. 1 for constructing water-works and electric light plants. H. Q. Bell, mayor.

Winnipeg, Man.—Bids are asked until Nov. 15 for furnishing 15-mis. of assorted water pipe. H. N. Ruttan, cy. engr.

Chilocco, Ok.—Sealed bids are asked until Nov. 7 for constructing a water system at the school. S. M. McCowan, supt.

Camden, N. J.—Bids are asked until Dec. 17 for improving the present artesian water supply. Jas. Potter, chamn. water com.

New Ft. Lyon, Colo.—Bids are asked until Nov. 5 for constructing a water system at Navan Hospital, Navy Dept., Washington, D. C.

Washington, D. C.—Bids are asked until Nov. 4 for furnishing water meters, etc. H. F. Hodges, genl. purchasing agt. Isthmian Canal comn.

Lewiston, Idaho.—Bids are asked until Nov. 11 for furnishing c. i. pipe, gate valves, valve boxes, hydrants, etc. John E. Nickerson, cy. clk.

Fort Morgan, Ala.—Bids are asked until Nov. 14 for constructing buildings for pumphouse, installing 2 boilers, 2 pumps, etc. Capt. L. F. Garrard.

Sheridan, Wyo.—Bids are asked until Nov. 14 for constructing an 8-in. c. i. water main from the U. S. reservoir to Ft. McKenzie. Capt. Wm. D. Davis, Q. M.

Philadelphia, Pa.—Bids are asked until Nov. 4 for furnishing ventilators of boiler house, pumping engine for Belmont high service ppg. station, pipe fittings, etc. Geo. R. Sterans, dir. pub. wks.

Atlanta, Ga.—Bids are asked until Nov. 12 for 13,000-ft. of 36-in. water pipe, to be c. i. steel riveted, reinforced concrete, wood pipe, etc. Bids are asked until Nov. 25 for constructing building on foundation furnished by city, making connections with 36-in. suction and 30-in. discharge mains of water-works and 10-in. steam main at pumping station No. 2, installing centrifugal pumping engines, etc. Bd. water comrs.

CONTRACTS AWARDED.

Duquoin, Ill.—The contract for constructing a water-works system was awarded to Wm. Tunney, of Joliet, Ill., for $48,205.

Columbus, O.—The contract for laying a mile of pipe from the filtration plant to this city was awarded to Westwater & Casey, for $163,906.60.

Fall River, Mass.—R. D. Wood & Co., of Philadelphia, was awarded the contract for furnishing 1600-ft. of 12-in. water pipe at $32 per gross ton.

Bangor, Me.—Orman B. Humphrey was awarded the contract for furnishing a forced draft apparatus for the boiler plant at the water-works pumping station.

Northboro, Mass.—A contract for cleaning the town reservoir has been awarded to Augustus Scocier, of South Framingham, at 46 cts. a cu. yd. for all excavations.

Belle Fourche, S. D.—The contract for constructing and completing a portion of the South Canal, Belle Fourche Irrigation Project, was awarded to Devore Bros. & Farlay, of Vale, S. D., for $103,500.

BRIDGES.

Richmond, Ind.—Bids are asked until Nov. 9 for constructing 8 bridges. Co. Comrs.

Ashland, O.—Sealed bids are asked until Nov. 4 for constructing a bridge. E. B. Westover, co. audt.

Crown Point, Ind.—Bids are asked until Nov. 4 for constructing an iron bridge in Calumet twp. Co. audt.

Marion, Ind.—Bids are asked until Nov. 5 for constructing 4 concrete bridges. Harry Goldwaithe, co. audt.

Redding, Cal.—Bids are asked until Nov. 8 for building a bridge across Sacramento river. S. N. Witherow, clk.

Wharton, Tex.—Bids are asked until Nov. 11 for constructing a steel highway bridge. G. S. Gordon, co. judge.

Troy, O.—Bids are asked until Nov. 12 for constructing a bridge over the Miami & Erie canal. E. E. Pearson, co. audt.

Jasper, Ind.—Bids are asked until Nov. 4 for building steel and repairing a number of bridges. M. A. Sweeney, co. audt.

Washington, Pa.—Bids are asked until Nov. 8 for building a joint county bridge across Monongahela river. Wm. Wylie, co. engr.

Muncie,, Ind.—Bids are asked until Nov. 6 for building a bridge across Mississinewa river and one across White river. Jos. E. Davis, co. audt.

Glendive, Mont.—Bids are asked until Nov. 15 for constructing 34 steel highway bridges. G. W. Woodruff, acting secy. U. S. Reclamation Service.

Des Moines, Ia.—Sealed bids are asked until Nov. 9 for constructing a reinforced concrete culvert at 30th and North sts. W. W. Wise, chmn. B. P. W.

Milwaukee, Wis.—The contract for constructing Grand ave. viaduct of reinforced concrete was awarded to the Newton Engineering Co., for $372,000.

Atlantic City, N. J.—Sealed bids are asked until Nov. 6 for constructing a county highway bridge on Harbor Lane, Somers Point City. Frank Enderlin, chmn. bridge com.

Hamilton, O.—Sealed bids are asked until Nov. 12 for constructing a concrete sub-structure of a bridge over Two Mile creek on Seven Mile pike. Christ. Pabst, co. audt.

Cincinnati, O.—Bids are asked until Nov. 8 for reflooring the suspension bridge over White Water river, near Harrison. Stanley Struble, prest. co. comrs. Bids are asked until Nov. 15 for repairing a bridge over Big Miami river.

Chicago, Ill.—Special. H. M. North, engineer in charge of construction of the Lake Shore and Michigan Southern Railway has awarded the contract for the concrete piles for the footings of the Cuyahoga viaduct of the Cleveland Shore Line Road to the Raymond Concrete Pile Company, of Chicago and New York.

STREET LIGHTING.

Akron, Ia.—Voted to install an electric light plant.

Chico, Cal.—Bids are asked until Nov. 12 for constructing an electric light plant. L. D. Macy.

Kokomo, Ind.—Bids are asked until Nov. 8 for furnishing electric lights for this city. W. T. Meck, cy. clk.

Minneapolis, Minn.—Bids are asked until Nov. 8 for gas and electric street lighting. L. A. Lydiard, cy. clk.

Pierre, S. D.—Bids are asked until Nov. 4 for constructing an electric light plant. Comr. Indian Affairs, Wash., D. C.

Calcutta, India—Bids are asked until Dec. 31 for lighting this town by electricity, gas, oil or other method. Municipal council.

Corlett (Randolph P. O.), O.—Sealed bids are asked until Nov. 6 for supplying this village with street lighting. W. H. Jantzen, vil. clk.

New Ft. Lyon, Colo.—Bids are asked until Nov. 9 for erecting central power, light and heat plant at Naval Hospital. Navy Dept., Wash. D. C.

Charleston, S. C.—Bids are asked until Nov. 15 for lighting streets and public buildings for 1, 2 or 4 yrs. Ion Simons, cy. electrician.

Washington, D. C.—Bids are asked until Nov. 4 for furnishing electrical fixtures for Isthmian Canal Comn. H. F. Hodges, purchasing agt.

Millen, Ga.—Bids are asked until Dec. 1 for constructing electric railway and power plant to serve Red Fork, Tulsa and other places. J. Robt. Burnham, engr., Tulsa.

Knightstown, Ind.—An ordinance was passed Oct. 22 providing for the issue of bonds for the purchase of new machinery for the electric light plant and power house.

Princeton, Ill.—Bids are asked until Nov. 20 for the purchase of the municipal electric light plant and system owned and operated by the city. J. M. Farrell, cy. clk.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Oak Park, Ill.—The contract for building a garbage crematory was awarded to Lewis & Kitchens, 433 Wabash ave., Chicago.

Waco, Tex.—The contract for constructing a garbage crematory was awarded to the Dixon Engineering & Construction Co., of Toledo, O., for $7500.

Ft. Benjamin Harrison, Ind.—The contract for constructing a garbage crematory was awarded to Lewis & Kitchen, 1200 Michigan ave., Chicago, for $4200.

PARKS.

Worcester, Mass.—City council has adopted an order instructing the parks commissioner to consider the advisability of the purchase of the Flatiron building for park purposes.

FIRE APPARATUS.

Belleville, N. J.—Final preparations for installing a Gamewell fire alarm system have been made.

Moorhead, Minn.—Bids are asked until Nov. 4 for 1000-ft. of 2½-in. fire hose. H. E. Roberts, cy. clk.

SATISFACTION

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Municipal Engineering Co.:

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FRANK HARDING,
Road Commissioner.

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Rushville, Neb., Oct. 21, '07.
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* * * I do not want to miss a number, as I consider it a model of its kind.

J. G. BEARD.

VERY SATISFACTORY

Cleveland, Ohio, Oct. 10, '07.
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Enclosed please find draft for subscription to Municipal Engineering and Hand Book. Have found them very satisfactory thus far.

H. O. WAY.

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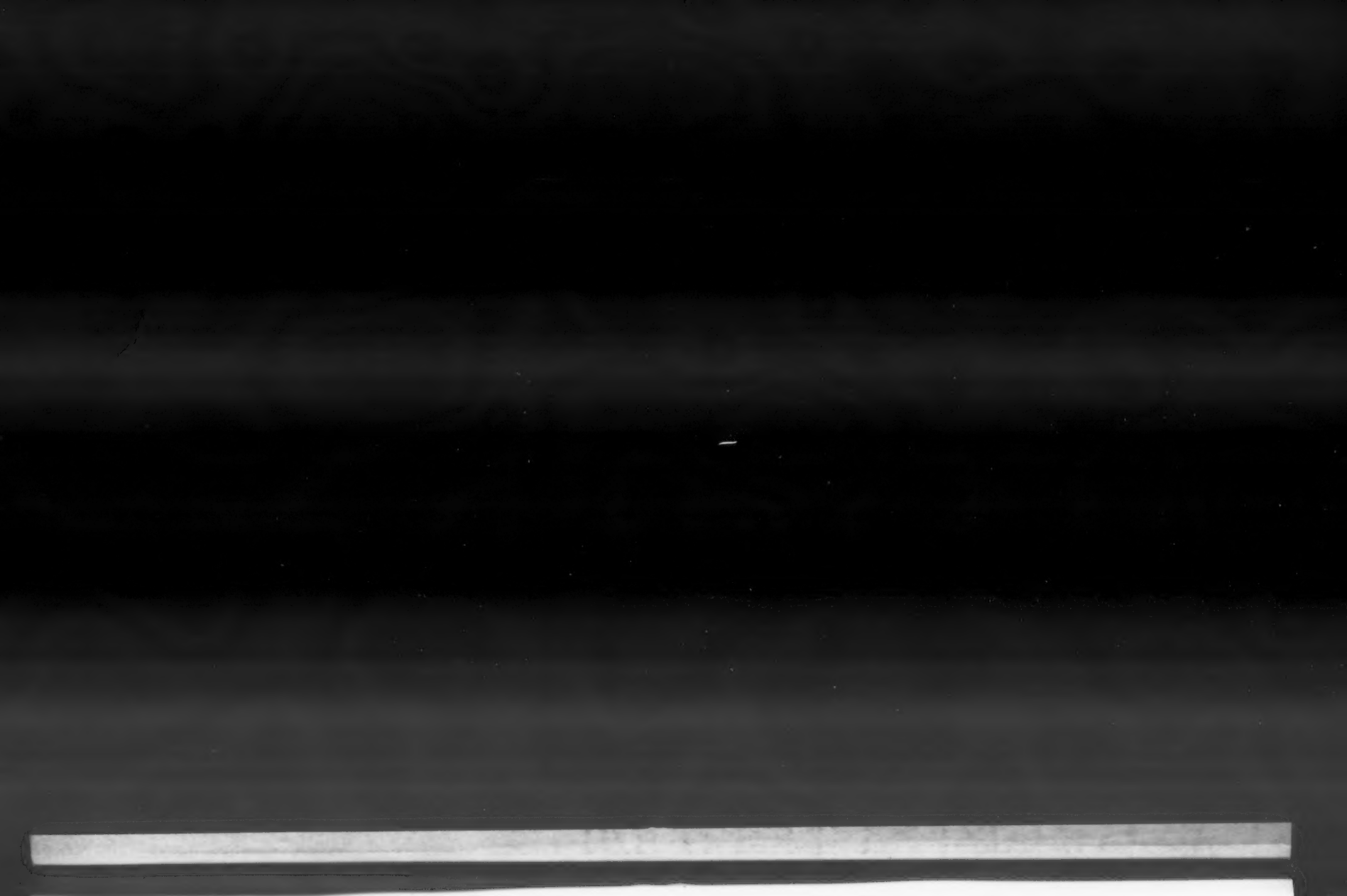
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